THIRTEENTH ANNUAL

CELEBRATION OF SCHOLARSHIP

APRIL 23, 2025

Three Minute Thesis Competition

STEM & HASS Slams

APRIL 24, 2025

Dr. Schlachter Award Finalist Presentations

Br. Joel Damian Business Pitch Competition

Concurrent Sessions

Poster Presentations

Creative Works

Art Gallery Talk

Awards Program

PROGRAM

WEDNESDAY, APRIL 23, 2025

SESSION	TIME	LOCATION	PRESENTERS
3MT Competition	12–12:50PM	DL 250	Graduate students presenting their thesis or dissertation idea in only 3 minutes.
HASS Slam / STEM Slam Humanities, Arts, and Social Science disciplines • Science, Technology, Engineering, and Mathematics disciplines	1-1:50PM	DL 250	Undergraduate students present three minute "elevator pitches" of their research projects using a single slide.

THURSDAY, APRIL 24, 2025

SESSION	TIME	LOCATION	PRESENTERS
Dr. Stephany Schlachter Finalists	10AM-12PM	DL 250	Students selected as finalists for the Dr. Stephany Schlachter Excellence in Undergraduate Scholarship Award.
Student Presenter Luncheon	12–1PM	Fieldhouse	All student presenters are welcome to come together for a community meal.
BR. JOEL DAMIAN BUSINESS PITCH COMPETITION			
Business Pitch Competition	1–4:30PM	Convocation Hall	Student projects, as overseen by the Stahl Center.
CONCURRENT SESSIONS			
Session I	1–2PM	Academic Science Center	Student(s) with Faculty Mentor(s) selected through review of submitted applications.
Session II	2:15–3:15PM		
Session III	3:30–4:30PM		
POSTER PRESENTATIONS			
Group A	1–2PM	Lewis Fieldhouse	Student(s) with Faculty Mentor(s) selected through review of submitted applications.
Group B	2:15–3:15PM		
Group C	3:30–4:30PM		
CREATIVE WORKS			
President's Art Exhibition	9AM-9PM	Art Gallery	Student work, mentored by Faculty, selected through review of submitted applications.
Gallery Talk	2–3PM		
Creative Works	3:10–4:30PM	Keith White Theatre	
OTHER EVENTS			
President's Reception	4:30–5:30PM	Lewis Fieldhouse	a) all student presenters with their faculty mentors; b) moderators, judges and other event volunteers.
Awards Program	5:30–6PM		
Preview Night for "Ride the Cyclone"	7:30PM	Philip Lynch Theatre	Undergraduate student theatrical performances.

GENERAL INFORMATION

Lewis University proudly supports the 13th Annual Celebration of Scholarship, a symposium dedicated to spotlighting the scholarly and artistic work of both undergraduate and graduate students. Throughout two days of events, Lewis University students and recent alumni present their original work in various formats, such as oral presentations, posters, performances, exhibits, roundtable discussions, three minute rapid-fire talks, and business pitches, reflecting the richness of scholarly and creative endeavors across the university. These forums provide presenters an opportunity to showcase their research and creative projects, marking a key milestone in their academic careers and encouraging them to explore future opportunities for growth. Celebration of Scholarship highlights the diverse talents and intellectual contributions of the Lewis University student body from various disciplines, and all members of the community are welcome to attend.

The Lewis University Celebration of Scholarship will present scholarly work in the following formats:

THREE MINUTE THESIS (3MT)

Science and scholarship can sometimes be seen as too technical and exclusive to those who do not study it, but it does not have to be that way! This presentation category is open to graduate students only. Students presenting in this format will present their original scholarship in 180 seconds, in a form that can be understood by individuals without any background knowledge in the research area, using only one presentation slide.

STEM / HASS SLAM

This event is similar to the Three Minute Thesis category, but is open to undergraduate students only. Undergraduate STEM (Science, Technology, Engineering, Math, and Computer Science) students and Undergraduate HASS (Humanities, Arts, Social Sciences) students will present their original scholarship in three minutes, using only one presentation slide, aimed at making their work understandable to those outside their discipline.

BR. JOEL DAMIAN, FSC, BUSINESS PITCH COMPETITION

The Br. Joel Damian, FSC, Business Plan and Pitch Competition, hosted by the Lowell Stahl Center for Entrepreneurship and the College of Business, encourages entrepreneurship among students throughout the Lewis community. The College of Business recognizes that potentially successful business ideas can come from a wide range of disciplines and may originate from an individual or a group of individuals. Projects will be presented from 1:00 to 4:30 PM in St. Charles Borromeo Convocation Hall.

CONCURRENT SESSIONS

Students will deliver 15-minute presentations on their research topics or papers, with each hour-long session featuring multiple student presentations. These sessions will take place in the Academic Science Center from 1:00 to 4:30 PM.

ROUNDTABLE/PANEL SESSIONS

Roundtable and Panel discussions are highly collaborative formats in which each presenter contributes comments and questions to a scholarly conversation that develops over the course of 60 minutes. These sessions take place as part of the concurrent sessions in the Academic Science Center from 1:00 to 4:30 PM.

POSTER PRESENTATIONS

Scholarly posters will feature the results of research projects, internships and class presentations. Posters will be displayed in the Lewis Fieldhouse from 1:00 to 4:30 PM with the authors present at times as designated in this program.

ART GALLERY TALK

Exhibits will be on display throughout the day with a special Gallery Talk featuring winners of the President's Art Exhibition from 2:00 to 3:00 PM.

CREATIVE WORK PERFORMANCES

These performances will showcase pieces from various fine arts fields including music, art, theater, and poetry, occurring from 3:10 to 4:30 PM in the Keith White Theatre.

LEWIS UNIVERSITY

Dear Colleagues,

It is my privilege to welcome everyone to the 13th Annual Celebration of Scholarship. I am pleased to be part of this important celebration that recognizes the scholarly, entrepreneurial and creative accomplishments of the students of Lewis University.

This year's Celebration will include more than 290 students presenting their creative and scholarly work in a variety of traditional formats, including concurrent presentations, poster presentations, business pitch competitions, panel presentations and creative work performances. This will be the third year we offer our two exciting three-minute competitions: Three Minute Thesis for graduate students and STEM Slam/HASS Slam for undergraduate STEM and Humanities, Arts, and Social Sciences students. This dynamic competition highlights the scholarship of our graduate students, who will condense their dissertation or thesis project into a compelling three-minute presentation, using one single slide. We are also excited to continue the undergraduate STEM Slam and Humanities, Arts, and Social Sciences (HASS) Slam as an important part of our event lineup this year. Modeled after 3MT and the STEM Slam, these Slams invite students to present their scholarship in only 180 seconds, making it accessible to those without a background in the discipline. Artwork from the President's 17th Annual Art Competition will also be on display throughout the day on April 24.

We will continue to offer the Dr. Stephany Schlachter Excellence in Undergraduate Scholarship Award which provides a $2,000 scholarship to one student who performs and presents outstanding research. Five finalists whose scholarship has been pre-evaluated by faculty judges will compete for this prestigious award during one concurrent session on April 24th. The Student's Choice Awards will also be given to students who earn the highest number of student votes.

This celebration is possible because of the commitment of many faculty and staff. Thank you to the Office of Graduate Studies, the Celebration of Scholarship Coordinating Committee, the subcommittees, and the many volunteers who give their time to make this event a success. And special recognition and gratitude to Dr. Marie Meyer, Associate Professor of Mathematics, and Dr. Matthew Domico, Associate Professor of Psychology who have co-chaired this event for the last four years. This will be the last year that Dr. Meyer and Dr. Domico will Co-Chair this event and we are so grateful for the enhancements they have added to this amazing celebration.

Student and faculty research, scholarly pursuit, and creative works are fundamental to the life of the University. It is with great pride we celebrate the work that has been done and with great hope we look to the future to see these efforts continued. Enjoy this Celebration of Scholarship and blessings to all.

Sincerely,

David J. Livingston, Ph.D.
President, Lewis University

Dear Colleagues:

I'm pleased to introduce Lewis University's 13th Annual Celebration of Scholarship, which highlights the research, scholarship and creative accomplishments of our students and faculty.

The Celebration brings to life our Mission values of knowledge, wisdom, justice, fidelity and association. In concert with our Mission values, we highly value academic excellence grounded in research, scholarship and creative activity that responds to the needs of society, along with a transformative student experience that emphasizes impact and experiential learning. The Celebration embodies this vision in inspiring and meaningful ways.

As always, this year's Celebration features the innovative and original ideas of our students. Over 290 students are presenting this year—through concurrent sessions, poster presentations, panel presentations, Business Pitch competitions, exhibits and performances of creative work. The Three Minute Thesis (3MT) and STEM and HASS Slams return for the third year, clearly establishing new traditions that respond to the drive to make scholarship relevant and effective in society. Both 3MT and the STEM/HASS Slams are designed to challenge students to communicate complex ideas in a clear and concise manner that is engaging and compelling to people who are not experts.

Also in its third year, the Students' Choice Award will be granted to the students in sessions throughout the day whose work earns the highest number of student votes. I'm delighted that we will continue many of our established traditions as well, including multiple awards granted by faculty panels, culminating in the Dr. Stephany Schlachter Excellence in Undergraduate Scholarship Award, honoring our former provost who supported the Celebration in countless ways as it came to life during her tenure.

I am grateful for all those who have worked diligently to make this Celebration a reality and a success this year. Thank you to the many faculty and staff who serve on the Celebration of Scholarship Coordinating Committee, various sub-committees, and in other volunteer capacities. A special thanks to co-chairs Dr. Matthew Domico, Associate Professor of Psychology, and Dr. Marie Meyer, Associate Professor of Mathematics.

The spirit of association permeates this day and speaks to our commitment to academic excellence, collaboration, and community.

Sincerely,

Dr. Christopher Sindt
Provost

3MT® THREE MINUTE THESIS
FOUNDED BY THE UNIVERSITY OF QUEENSLAND

WEDNESDAY • APRIL 23

12–1PM

DL-250

12:00 Physiochemical Interactions Between Reductive Small Molecule Surfactants and CeO2 Nanoparticles in Sono-Activated Post-CMP Cleaning

Graduate Student Project in Natural Sciences

Elizabeth Maeve McDonnell
Contributor: Sydney Tremblay

Dr. Jason Keleher

12:04 Markers of the Mind: A Scoping Review of Biomarkers for Cognitive Tracking in TBI

Graduate Student Project in Nursing & Health Professions

Isidro Alejandro Galvez

Dr. Ann Guernon

12:08 An Exploratory Investigation of Community Outreach by Law Enforcement in the Development of Firearm Education for Children

Graduate Student Project in Education & Social Sciences

Hayley O'Leary
Contributors: Abaigeal Collins, Julianna Henrichs, Taylor Gugliuzza

Dr. Hannah Klein

12:12 Thermodynamic Analysis of MOF Thin-Layer Formation via Anodic Dissolution

Graduate Student Project in Natural Sciences

Adan Martinez

Dr. Daniel Kissel

12:16 Understanding the Interfacial Dynamics of a Two-Layer Responsive Hydrogel System for Wound Healing Applications

Graduate Student Project in Natural Sciences

Katey Sheets
Contributors: Jadyn C. Dominguez, Connor J. Keating

Dr. Jason Keleher

12:20 Analyzing the Influence of Megasonic Parameters on the Effectiveness of Chemical Additives in the Optimization of Post-Chemical Mechanical Planarization Cleaning Processes for Silicon Carbide Substrates

Graduate Student Project in Natural Sciences

Piper Smith

Dr. Jason Keleher

12:24 Examining the 21st Century Policing Task Force's Impact through a Cultural Competence and Critical Race Lens: "A Critical Analysis of Law Enforcement Training, Education and Police Discretion"

Graduate Student Project in Education & Social Sciences

Angela Patterson

Dr. Erica Davila

12:28 Development of a Parent Tool Kit for Best Practices in Safe Firearm Storage and Behaviors to Keep Kids Safe

Graduate Student Project in Education & Social Sciences

Abaigeal Collins
Contributors: Juliana Henricks, Hayley O'Leary, Taylor Gugliuzza

Dr. Hannah Klein

12:32 An Exploratory Investigation of Preschools' Role in Firearm Education for Children and Families

Graduate Student Project in Education & Social Sciences

Julianna Henrichs
Contributors: Hayley O'Leary, Abaigeal Collins, Taylor Gugliuzza

Dr. Hannah Klein

12:36 A Critical Examination of the Implementation of Multi-Tiered Systems of Support and the Impact of Race Through the Lens of Critical Race Theory

Graduate Student Project in Education & Social Sciences

Blanca Hipolito

Dr. Erica Davila

12:40 Real-Time Phishing Detection and Preventive Education System

Graduate Student Project in Engineering, Computer Science, and Mathematics

Hajira Sultana

Dr. Rami Khasawneh

12:44 Neutronics Simulations for Energy Extraction of a Direct Fusion Drive

Graduate Student Project in Natural Sciences

Tom Harless

Dr. Ryan Hooper

12:48 Developing Broad Spectrum Metallo-Beta-Lactamase Inhibitors Utilizing 8-Hydroxyqinoline as a Scaffold in Virtual Screening

Graduate Student Project in Natural Sciences

Anthony Baudino

Dr. Kari Stone

12:52 Enhancing Chloroperoxidase's Catalytic Efficiency on a Solid Surface for Stability and Reusability in Dye Degradation

Graduate Student Project in Natural Sciences

Norman Paz-Ramirez
Contributors: Audrey Ang, Jacob Redwinski

Dr. Kari Stone

STEM & HASS SLAMS

WEDNESDAY • APRIL 23

1–2PM

DL-250

1:10 The Toll it Takes and Excerpt from "Advocate"

Undergraduate Student Project in Performing Arts

Sara "Sei" Barbour

Dr. Kevin Trudeau

1:14 Degradation of Methyl Orange Using Enzyme Crosslinked Silica

Undergraduate Student Project in Natural Sciences

Jacob Redwinski

Dr. Kari Stone

1:18 Covalent Crosslinking of Cellulose-Based Hydrogels Utilizing Carboxylic Acid Derivatives for Enhanced Structural Integrity

Undergraduate Student Project in Natural Sciences

Rebecca S. Ratajczyk

Contributors: Connor J. Keating, Ezra Samson, Katey M. Sheets

Dr. Jason Keleher

1:22 Muon-to-Electron (Mu2e) Conversion Experiment: Pixel Cooling Project

Undergraduate Student Project in Natural Sciences

Emma Elizabeth Teo

Dr. Ryan Hooper

1:26 Investigating the Non-Canonical Role of Cyclin D3 in Gene Regulation Using a Neutrophil Model

Undergraduate Student Project in Natural Sciences

Aaron L. Allred

Dr. Sarah Powers

1:30 Enhancing Chemical Mechanical Planarization (CMP) Performance Through Catalytic Surface Oxidation of Wide Band Gap (WBG) Substrates

Undergraduate Student Project in Natural Sciences

Andrew Murphy

Contributors: Amanda Warfield, Kiersten Smith, Austin Rockaitis

Dr. Jason Keleher

1:34 Project W.A.T.C.H (Water Antigen Tracking with Cellulose Hydrogels): A Biopolymeric Scaffold for Advanced Sensing Applications

Undergraduate Student Project in Natural Sciences

Jadyn Dominguez

Contributors: Aine Ronan, Connor Keating

Dr. Jason Keleher, Dr. Sarah Powers

1:38 Adsorptive and Electrochemical Methods for Water Reclamation in Chemical Mechanical Planarization (CMP) Processes

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Angelina Martinez

Contributor: Rebecca S. Ratajczck

Dr. Jason Keleher, Dr. Sarah Powers

1:42 Provocation within Education

Undergraduate Student Project in Education & Social Sciences

Janelle Chanece Williams

Dr. Juana Reyes

DR. STEPHANY SCHLACHTER AWARD

THURSDAY • APRIL 24

10AM–12PM

DL-250

106 "Seeing" Music Using Lasers to Measure Vibrational String Frequencies

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

When playing any type of string instrument, the notes that we hear are differences in sound pressure created due to the vibration of the strings. Traditionally, when recording music or any type of sound, sound pressure devices/ microphones simply listen to the notes being played, but are often filled with extra noises and other unwanted frequencies which is why most music recordings are done in noise-proof rooms to reduce this problem. This project aims to intersect music and technology by exploring the use of lasers to interpret the sounds of the guitar. By focusing a laser onto the guitar string and observing the subtle shifts in the laser's reflection on the guitar string, measurable data signals that are directly tied to the string's vibration frequencies are able to be read. This is essentially a method that allows the translation of string oscillation to readable computer data in real time that does not have the downsides of audio pickups such as frequency interference. The results of this project could provide potential benefits for non-invasive affordable musical analysis as well as enhanced digital frequency data for not only guitars but for all string instruments. Exploring the ability to "see" music with optical sensors may also provide highly accurate means of real-time feedback for musicians as well as provide musicians a method of recording their music without the investment of noise-cancelling rooms.

Tanny Do

Dr. Phillip Chumbley

155 Investigation of Polymer-MOF Hybrid Composite Materials for Electrochemical Capacitors

Undergraduate Student Project in Natural Sciences

Electrochemical energy storage has become a popular focus in green energy research in recent years. These energy storage devices are known as electrochemical capacitors or, more commonly, super capacitors. Super capacitors store energy by mobilizing polarizing charges at the electrochemical double layer, or through faradic interactions on the surface of the electrode, or by doing both. Metal-organic Frameworks (MOFs) have emerged as ideal materials for electrochemical capacitors because of their high surface area and tunability. However, these materials often suffer from poor conductivity, requiring modifications with conductive materials to improve charge transport. Conductive organic polymers, such as polyaniline (PANI), are often integrated into MOF frameworks to improve conductivity and create faradaic composite materials with high surface area. Integrating these composite materials into electrode design is challenging because film deposition methods rely on weak electrostatic interactions that result in instability. This work presents a novel synthetic approach developed in the Kissel research lab that increases film stability through formation of a chemical bond that covalently anchors MOF to graphite-PANI electrodes. The procedure was repeated for several different MOFs, including MiL-125-NH2, UiO-66-NH2, MiL-125-NH2@ZIF-67, and MiL-100-Fe. The resulting composite materials were characterized using XRD, BET surface area analysis, and FTIR-ATR spectroscopy. The electrochemical activity of each electrode was investigated using Linear Sweep Voltammetry, Cyclic Voltammetry, and Galvanostatic charge-discharge techniques. The structure and morphology of the electrodes were determined with White-light interferometry, SEM imaging, EDS analysis, and FTIR-ATR spectroscopy.

Nathan Hajek

Contributors: Adan Martinez, Adam Makhlouf, Johan Gonzalez

Dr. Daniel Kissel

92 Mathematically Modeling Recurrent *C. difficile* Infections in Long-Term Care Facilities

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

This project investigates the effects of both hospital and community transmission of *Clostridioides difficile (C. difficile)* using an agent-based model (ABM) to determine optimal strategies for mitigating the spread of this bacteria. While *C. difficile* remains one of the most common causes of healthcare-associated infections in the United States, data from the Emerging Infections Program at the Centers for Disease Control and Prevention has sho wn a decrease in the overall burden of *C. difficile* in healthcare settings from 2011 to 2017. During that same time period, no such decrease occurred in community-associated infection, which accounted for nearly 50% of the burden of *C. difficile* infections (CDIs) in 2017. Many mathematical models have been developed to understand *C. difficile* transmission in healthcare settings, but there has been a noticeable absence of models to understand its spread in communities, especially with a focus on what could lead to a CDI outbreak. ABMs consider the individual behaviors of system components by defining a set of rules that govern how individuals interact on a spatial grid. These types of models rely heavily on probabilities, which allow for the randomness of individual decision-making to be simulated. In developing and analyzing an ABM, we will help pinpoint the origin and main causes of a CDI outbreak within hospitals and communities as well as methods to eliminate or reduce the potential spread of the bacteria.

Zachary Campbell

Dr. Cara Sulyok

DR. STEPHANY SCHLACHTER AWARD

THURSDAY • APRIL 24

10AM–12PM

DL-250

30 Muon-to-Electron (Mu2e) Conversion Experiment: Pixel Cooling Project

Undergraduate Student Project in Natural Sciences

The Muon-to-Electron conversion experiment (Mu2e) has been an ongoing project at Fermi National Accelerator Laboratory since 2015. The basis of this particle physics experiment lies in the attempt to convert a muon into an electron without neutrino emission. The Standard Model—the current governing theory of particle physics—does not allow this transformation to occur. Thus, we are searching for evidence of particle behavior beyond the current Standard Model, which would signal the existence of new particles or new forces of nature. The pixel cooling component of this experiment plays a crucial role in successfully detecting this transformation. Silicon pixel plane detector systems used in the Mu2e experiment drastically degrade if they become too hot. Poor quality readings and uninterpretable data will result from this overheating, which had been observed in simulated trials prior to 2025. There are two work-arounds to fix this problem which will be addressed in this work: running a 50/50 ethylene glycol-water mixture or thermal C5 fluid through small tubes on the pixel planes to serve as a coolant, and constructing a new pixel plane frame out of polyetheretherketone (P.E.E.K.) to secure the cooling tubes in place. It is the hope that implementing both of these adjustments will keep the pixel planes at a stable operating temperature, allowing the Mu2e experiment to be at a fully-functioning state for data collection.

Emma Teo

Dr. Ryan Hooper

82 The Simplification of Everything

Undergraduate Student Project in Visual Arts

An artistic study on the future of art reflecting the effects of widespread media consumption. This artwork will represent the schizophrenic-inducing algorithms of social media, and how overconsumption leaves no energy for individual creative exploration. Creativity thrives on sincerity and uniqueness, but it struggles to survive in a world dominated by digital noise. The power of art is shown through its expression of simple authenticity in a world dominated by the internet. Paintings: *https://drive.google.com/drive/folders/1-1YbLaE0jlQ6psh0RFXgQsLAWE-WVrkn?usp=drive_link*

Katie Melzer

Leslie Colonna

BR. JOEL DAMIAN BUSINESS PITCH COMPETITION

THURSDAY • APRIL 24

1–4:30PM

CONVOCATION HALL

GlowAI – Personalized Skin Analysis and Care

Graduate Student in Cybersecurity

Many people struggle to understand their skin type and conditions, often relying on online trends or guesswork that can lead to ineffective or even harmful skincare choices. GlowAI is an AI-powered tool that analyzes user-uploaded facial images to assess skin health indicators such as acne, dryness, and oiliness. Based on this analysis, it provides personalized suggestions for natural remedies, diet tips, and tailored skincare product recommendations. GlowAI aims to make accurate skin insights and self-care accessible and affordable, eliminating the need for costly dermatology visits.

Hajira Sultana

Fidelis Match

Graduate Student in Data Science

Fidelis Match is building more than just a platform. It is envisioning Chicago's first dedicated padel community. As one of the fastest-growing racquet sports worldwide, padel is exciting, social, and accessible, yet many players struggle to find a place to start. Fidelis Match connects players of all skill levels with each other and with local facilities through organized leagues, tournaments, coaching, and casual events. The platform serves as a central hub for padel in the city by offering smart matchmaking, easy access to courts, and a welcoming space for players to develop their skills and make lasting connections. At its core, Fidelis Match is about community. It brings people together through sport and creates an inclusive environment where anyone can get involved, stay active, and feel a sense of belonging. By focusing on the unique advantage of this society with enhanced accessibility and connection, Fidelis Match aims to grow the local padel scene and eventually expand into other racquet sports and cities.

Anabel Aguilar Ramirez, Omer Gorgun

NextGiver

Graduate Student in Data Science

NextGiver is a tech-driven platform revolutionizing how young people engage with volunteer opportunities. It seamlessly connects passionate individuals with verified nonprofit organizations, ensuring a perfect match between skills, interests, and social impact. By simplifying the process through AI-powered recommendations and a user-friendly interface, the platform makes volunteering more accessible, efficient, and rewarding—empowering a new generation of changemakers to contribute meaningfully to their communities.

Ayesha Fatima

Lumi

Undergraduate Student in Theatre/Graphic Design

My product is Lumi, a wind-resistant umbrella available in two sizes: small and large. During its development, I observed that many people lack an umbrella and resort to alternatives like walking with their hoods down, covering their heads with books, sharing a small umbrella with a friend, having theirs break due to high winds, forgetting them at home, not being aware of the weather, or accepting being wet and walking through the rain. Similar to renting Lime scooters, you can rent umbrellas at colleges and throughout the city using the Lumi app. If you need to get to another building, you can rent an umbrella, so you won't be drenched while walking in the rain. This rental system offers convenience and accessibility, ensuring you have an umbrella when you need one. Furthermore, the system reduces waste by promoting the sharing and reuse of umbrellas, contributing to a more sustainable environment. Additionally, people can purchase umbrellas on the website to keep.

Tia Nicholson-Bourn

VisuLens3D

Graduate Student in Computer Science

3D web application that allows users to see how different lenses will look and fit within eyeglass frames based on their unique prescriptions and chosen lens materials. This app will dynamically generate lenses and adjust their thickness, curvature, and weight according to user input, providing realistic visualizations of how prescriptions strength and material choices affect lens appearance. Given thickness, the application intends to integrate with manually sourced data in order to get frame specifications, with this information the application can then show frame recommendations that may optimally fit your unique prescription.

Cesar I. Mendoza

Oatmealy

Graduate Student in Business Analytics

Oatmealy, a brand that focuses on ready to eat instant convenient, tastier, healthier Oatmeals, which requires no extra effort to reheat or cook or boil or defrost and takes only these 3 steps: (1) Go to the refrigerator, (2) Grab Oatmealy & Open lid, (3) Enjoy. So, customers can customize a 30 Oatmeal box set from 10 different classic oatmeal bowl options and 10 unique oatmeal drink options and get this customized 30 Oatmeal box set delivered within 24-48 hours to their doorstep. It's going to be a new revolution in the ready to eat food industry where, unlike other brands and products in the market, Oatmealy will offer pure convenience to every customer.

Mohsain Dashti

Nail Hut

Graduate Student in Business

Nail Hut is a hospital-grade nail clipper featuring a clear, removable Nail Cap specifically designed to catch and contain nail clippings. No more stray clippings flying across the room—just a clean, simple and convenient grooming experience.

Enoch Antwi

BR. JOEL DAMIAN BUSINESS PITCH COMPETITION

THURSDAY • APRIL 24

1–4:30PM

CONVOCATION HALL

CampusLink

Undergraduate Student in Business Administration

CampusLink is a business built to revolutionize transportation logistics on college campuses across America, provide entertainment and physical activity to students, and generate a source of passive income for lenders on the platform. For small to large sized campuses across the country a major pain point for College students is walking to their classes. Students have to be in multiple different buildings throughout their school day on opposite sides of campus and typically only have as little as 12-15 minutes in between classes for their commute. CampusLink will rely on a peer to peer scooter and bicycle lending model where a student that owns an eligible electric scooter or traditional bicycle can lend their scooter out to other students when they are not using it. There will be an app that facilitates these bookings where the rider and lender alike can have reviews and a booking history. Also there will be a GPS boundary where the scooter can operate, that will limit it to operating on the Campus boundaries and any nearby pedestrian trails only, no major roads.

Daniel Baumhart

Audiophonix

Undergraduate Student in Cybersecurity

Audiophonix is a real-time, AI-driven audio equalization platform that automatically adjusts sound based on user context, device, and environment. It eliminates the need for manual EQ configuration by applying intelligent presets and dynamic filters that optimize listening across any setting. The product addresses limitations in current EQ tools, which are typically static, user-dependent, and inconsistent across playback scenarios. Audiophonix uses machine learning models to adapt audio in real time, providing consistent high-quality output whether at home, in transit, or on the go. With the music streaming market exceeding $38B and consumer demand for high-resolution, immersive audio on the rise, Audiophonix targets a growing base of audiophiles, casual listeners, and premium streaming subscribers. The business model includes a freemium tier, premium subscriptions, and B2B licensing for integration with music and hardware platforms.

Daniel Monbrod

Laser Tuner

Undergraduate Student in Physics

Using lasers as well as photodiode sensors, the vibrational frequency of a string can be measured by looking at the sensor “flicker.” This essentially creates a noiseless frequency pickup that is able to read the musical notes of any string on a given instrument.

Tanny Do

Empowerment Through Employment

Undergraduate Student in Business Administration

This community-centered initiative provides personalized resume-building services and job search assistance to individuals experiencing homelessness in the local area. By offering tools, guidance, and support, the project seeks to remove key barriers to employment and help participants regain independence and stability. Services will include workshops and one-on-one coaching, designed to build confidence, enhance job readiness, and empower individuals to take the next step toward employment.

Diego Hernandez

SKP Bamboo Salt Company

Graduate Student in Business Analytics

Revitalizing Ancient Wisdom to Inspire Modern Wellness, Culinary Artistry, and Breakthrough Pharmaceutical & Cosmetic Innovations. The “bamboo salt” market is characterized by a variety of product forms, including coarse, fine, and powdered versions, catering to different culinary and health-related needs. Bamboo salt, also known as “jukyeom,” is a sea salt infused with minerals from bamboo and clay, created by roasting sea salt inside bamboo canisters and then baking them in a kiln. The bamboo salt market is experiencing growth driven by the increasing popularity of organic and natural products, as well as consumer interest in sustainable and environmentally friendly options. Bamboo salt is known for its low sodium level and variety of minerals, and its unique manufacturing method, which involves roasting salt in bamboo vessels, is believed to impart health benefits. Bamboo salt is believed to have various health benefits, including improved digestion, oral health, skin care, and inflammation reduction, although more scientific studies are needed to fully back up these claims. Bamboo salt production is considered eco-friendly because it relies on the natural burning of harvested bamboo waste, making it carbon neutral.

Srikanth Pathakamudi

THURSDAY • APRIL 24

CONCURRENT SESSION 1

1–2PM

AS-150-A

86 Enhancing Chloroperoxidase's Catalytic Efficiency on a Solid Surface for Stability and Reusability in Dye Degradation

Graduate Student Project in Natural Sciences

Increasing demand for enzymatic catalysts continues to expand across various industries; however, a significant limitation lies in their inherent instability in harsh environments, leading to deactivation and calling for innovative methods to promote stability. Generating stable biocatalysts has shown increased resilience and activity relative to free enzymes, gaining critical relevance in improving the industries' processes implementing toxic water remediation methods, such as dye degradation. Developing greener methods to degrade dyes is imperative, as harsh detergents typically fulfill the role. One promising method utilizes cost-effective and configurable solid surfaces (i.e., silica) as immobilization anchors where they offer high surface area, chemical resistance, and tunable surface properties that enhance enzyme activity, stability, and reusability, making them ideal for immobilizing enzymes, such as chloroperoxidase (CPO), in biocatalytic applications. CPO is an oxidoreductase that is an ideal candidate for dye degradation as dyes are targeted regio- and stereochemically generating non-toxic by-products, thereby mechanistically upholding the principles of green chemistry. Requiring H2O2 to activate CPO in these reactions directly is suboptimal; therefore, in-situ peroxide evolution is caused by glucose oxidase (GOx). Herein, the challenges of free CPO towards withstanding broader pH ranges, elevated temperatures, and exposure to organic solvents will be addressed. Furthermore, this work will provide insight into a novel biocatalyst built of a bi-enzymatic system on a silica substrate for dye degradation as composition and proficiency will be investigated.

Norman Paz-Ramirez
Contributors: Audrey Ang, Jacob Redwinski

Dr. Kari Stone

158 Developing Broad Spectrum Metallo-Beta-Lactamase Inhibitors Utilizing 8-Hydroxyqinoline as a Scaffold in Virtual Screening

Graduate Student Project in Natural Sciences

Antibiotic resistance poses a severe global health challenge, particularly due to the rise of metallo-beta-lactamases (MBLs) like the New Delhi MBL (NDM) and Verona Integron MBL (VIM) which have been found around the globe. These enzymes, which utilize zinc in their catalytic sites, render traditional Beta-lactamase inhibitors like clavulanic acid ineffective. As such, there is a critical need for novel inhibitors specifically targeting these MBLs. 8-hydroxyquinolines (8HQs), known for their zinc-chelating properties, present a promising scaffold for inhibitor development. This study employs in silico drug discovery tools, such as Schrödinger's Maestro, alongside experimental validation with clinical mutants of VIM and NDM, to design and optimize broad-spectrum MBL inhibitors based on the 8HQ framework. The goal is to develop new therapeutic options that can effectively counteract MBL-mediated antibiotic resistance, thus providing a foundation for combating this rapidly escalating public health threat.

Anthony Baudino

Dr. Kari Stone

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CONCURRENT SESSION 1

1–2PM

AS-155-A

44 An Exploratory Investigation of Preschools' Role in Firearm Education for Children and Families

Graduate Student Project in Education & Social Sciences

In 2020, firearms became the number one cause of death for children ages 1-18 in Illinois and across the United States. These deaths are not just from a rise in firearm violence and homicide, but can also be attributed to suicide, unintentional, and accidental deaths. Accidental injuries and deaths are the most common for young children. Many of these deaths could have been prevented if firearms were properly stored and kept away from children. There has been little research done on the most effective and best ways to educate individuals on safe storage, especially for preschool-aged children and their families. This exploratory study seeks to assess how an educational curriculum or campaign about firearm safety, including safe storage, for kids, parents, and preschool teachers could be introduced in preschool settings while addressing challenges related to child engagement and parental concerns. Through semi-structured interviews with preschool center directors, the study will examine current preschool policies on firearm-related discussions, strategies for addressing gunplay, and opportunities for integrating firearm safety education into early childhood curricula. Our findings will help preschools identify best practices for age-appropriate firearm safety discussions, effective parent engagement strategies, and the role of staff and external experts.

Julianna Henrichs

Contributors: Hayley O'Leary, Abaigeal Collins, Taylor Gugliuzza

Dr. Hannah Klein

45 An Exploratory Investigation of Community Outreach by Law Enforcement in the Development of Firearm Education for Children

Graduate Student Project in Education & Social Sciences

Firearms are currently the leading cause of death in the United States for children ages 1 to 18, with younger children experiencing high rates of injury and death from improperly stored firearms. We know from previous research that safe storage education has helped to reduce the number of deaths by firearms. While several educational programs for older youth and children focus on violence prevention topics like firearm safety, few programs educate preschool staff, parents, and children about firearm safety and storage. This exploratory study aims to identify the role of law enforcement in the development and implementation of firearm safety programs and campaigns. Through interviews with law enforcement employees who serve their communities as community outreach specialists or public education managers, we aim to gather the necessary information needed to develop a program or a campaign that can be implemented with preschool-aged kids. The interviews will help analyze community and public education programming and staffing, including current community education programs, the role of gun socialization, key information children should know about law enforcement and firearms, and approaches to teaching firearm safety to preschool-aged children. The findings will contribute to the development of an effective, evidence-based firearm education program for preschool staff, parents, and children. This program will ultimately help to reduce firearm-related deaths for children and provide them with an introduction to law enforcement.

Hayley O'Leary

Contributors: Abaigeal Collins, Julianna Henrichs, Taylor Gugliuzza

Dr. Hannah Klein

46 Development of a Parent Tool Kit for Best Practices in Safe Firearm Storage and Behaviors to Keep Kids Safe

Graduate Student Project in Education & Social Sciences

The leading cause of death for children aged 1-18 in the United States, including illinois, is from firearms. For younger children, these deaths often occur because firearms are not being stored properly and out of the reach of children. Education of proper gun storage and how to store firearms is crucial for parents in helping to prevent such tragedy from occurring. This also goes for parents who should think about firearm storage in other homes that their children visit, such as relatives' or friends' homes during visits and playdates. With this exploratory study we aim to educate the parents of preschool-aged children about what they should do within their own homes and when their children are visiting others. With interviews with law enforcement and daycare providers we will seek to develop tools parents can use to educate their own children, themselves, and others about what to do with firearms. This presentation will focus on best practices and tools parents can use to help prevent injuries and death by firearm for their loved ones.

Abaigeal Collins

Contributors: Juliana Henricks Hayley O'Learyz Taylor Gugliuzza

Dr. Hannah Klein

61 Exploratory Study for the Development of Child-appropriate Materials for Education About Firearm Safety

Graduate Student Project in Education & Social Sciences

As of 2020, the leading cause of death for children from the ages 1-18 in the United States is from firearms. Often injuries and deaths from firearms were due to children accessing them when they are not stored or secured correctly. Children as young as 6 months are able to pull a trigger on most firearms so keeping them out of the hands of children is essential. In today's culture, kids can become aware of what a gun is from a very early age, but there are very few in-school programs that teach children of all ages what to do when a gun is present. This exploratory study aims to develop tools that can be used to educate children in preschool about what to do and how to act when they see a gun. Through the use of activities designed to keep the children engaged and intrigued, preschool students will be made aware of how dangerous guns are to them. The activities will include coloring pages, songs, and other hands-on learning strategies to keep their attention. Our findings will support the development of an evidence-based firearm education program or campaign not only for the children, but also for others involved, including parents, school staff, and even law enforcement. This program's main goal will be to enhance child safety and knowledge on what guns are, but also bringing in other people from their own community, such as their teachers, parents, and law enforcement, to help get the main point across.

Taylor Gugliuzza

Contributors: Hayley O'Leary, Julianna Henrichs, Abaigeal Collins

Dr. Hannah Klein

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AS-156-A

16 #NAMIRockstars

Undergraduate Student Project in Humanities & Communication

Our Special Events Class of 2024 worked with Rockstars Garage and NAMI Will-Grundy to create an event advocating for mental health awareness. We worked in teams including entertainment/budget, catering/decor, fundraising/scholarship and social media/promotions. The goal for this event was to raise a total of $8,500 to benefit the NAMI Will-Grundy organization. This goal ended up being surpassed with a total of $13,800 raised. *https://osbrzek.wixsite.com/*namirockstars

Francesca Corso, Jinane Chahine

Tracy Hemmingway

51 Content Creation for Lewis University's Experiential Learning Program

Undergraduate Student Project in Humanities & Communication

In Writing Digital Media, we learned how to incorporate powerful language into rhetorical design through projects focused on community engaged learning. In doing this, we learned how to use different software programs like Canva and Wix, while also applying strong rhetorical choices in usable, accessible, and articulate language. We had the opportunity to experience Community Engaged Learning through the Lewis University Experiential Learning Program (EL). EL is a program located on campus that is dedicated to engaging students, staff, administration, and others in community engaged learning, to provide real-world professional connections to students through course-based or co-curricular experiences. For this project, we began by creating a proposal for the organization to evaluate that targeted student involvement, as the website was catered more towards the staff and administration of the university when we began the project. We did extensive research on the EL website, taking note of areas that could use our support to allow this new audience to utilize all of the experiences this program has to offer. Throughout this project, we worked alongside Laura Franklin and Laura Wilmarth Tyna to gain a better understanding of the program, as well as their goals for the future of EL. We provided them with promotional materials including, an infographic, a flyer, and a QR code, redesigned the website layout and language, organized charts for course registration alongside a chart for community-based activities/opportunities, and wrote a video script for their landing page. Our materials have since been implemented for the message of the Experiential Learning program to connect this larger demographic by providing information both physically and online. In collaborating with this community, we were given the opportunity to connect with the mission of the University and expand our knowledge both as students and as writers. We learned and successfully implemented helpful professional traits, such as proactive communication, language assessment, and time management skills. This project helped us to understand the importance of promotional content and language and how to use these tools to help improve our community.

Sam Poyner, Arista Brozovich

Dr. Jen Consilio

164 Presence in Performance: How 10 Years of Creating Changed Everything

Undergraduate Student Project in Visual Arts

For the past ten years, I've been exploring my art journey and how my life has changed as a result. I will go through the events of my personal experiences with art including my creative process as well as my struggles and successes. My work allowed me to ask myself what I really wanted to do moving forward. With this presentation, I aim to tell my story and emphasize the importance of the artistic journey.

Franchesca Ornelas

Kristin Callahan

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1–2PM

AS-157-A

125 Serbia Shoah Memorialization: A Comparative Study of Polish and Serbian Holocaust Memory

Undergraduate Student Project in Humanities & Communication

The Shoah in Serbia, in both its direct study and the study of its memory, is often overshadowed by the more broad scope of the Nazi's atrocities across Europe and the Ustashas brutality carried out in Croatia. The aim of this research project was to provide a more narrow historical narrative of the Shoah in Serbia, highlighting the rapid murder of Jews before the implementation of the Final Solution and analyzing how it has been memorialized and remembered in the country. Employing secondary sources that have translated archival materials, first-hand accounts of both the Shoah and the experience of Jews post World War II, along with comparative analysis of Holocaust memorialization in Poland to contextualize Serbia's own memorialization and memory. Through this research, I have found that there have been similar issues and patterns of Shoah memorialization in both Poland and Serbia, but also apparent distinct differences. Serbia has primarily gone through periods where the Shoah has been erased, marginalized, and even cleansed from the places where it had occurred, but with growing international attention; there has been movement toward recognition and preservation in recent years.

Henry Gilson

Dr. James Tallon

126 A Return to Morality: The Incoherence of Relativism, Universality, and Cultural Acquisition

Undergraduate Student Project in Humanities & Communication

In this project, I critique the thought of moral and cultural relativists, arguing that the logical inconsistencies of these theories are not only contradictory but harmful. Relativist theories claim that moral judgments are bound by "cultural agreements," clearly demonstrating culture as a foundation for morality while paradoxically rejecting the very notion of foundations. I mainly work within Gilbert Harman's relativist framework but often draw from other relativists such as Richard Rorty to reveal how relativist arguments perform this paradox. In doing so, I propose reevaluating morality not as a mere system of value positing, but as a universal biological function inherent to human beings. To justify my arguments, I draw on Noam Chomsky's theory of Universal Grammar to demonstrate how biological universals function, and why, ultimately, this understanding of morality is far more practical than the popularized relativistic concept of morality as somehow socially constructed. In fact, it could be said I argue the exact opposite of the relativists; that it is morality that constructs culture- not vice versa. This project aims to demonstrate how moral relativism is often propagated by governing institutions in efforts to avoid accountability for otherwise tyrannical practices. Ultimately, this work calls for a return to a morality rooted in human nature, providing a logical and natural justification for resisting oppressive institutions that violate these fundamental moral functions.

Samuel McFerron

Dr. Karen Davis

142 The Cuban Political Exile Experience

Undergraduate Student Project in Humanities & Communication

The Cuban Political Exile Experience seeks to analyze literary representations of the Cuban political exile, the Cuban Revolution, and how such events led to strained familial relationships. This is done by engaging in close textual analysis of Cristina Garcia's novel *Dreaming in Cuban*, specifically Lourdes and the Puente family, as well as by analyzing Achy Obejas' short story "We Came All the Way from Cuba So You Could Dress Like This?" As illustrated throughout the paper, reoccurring themes of the American Dream, autonomy, control, and generational differences are central to the experiences of Lourdes in *Dreaming in Cuban* which in turn helps to understand why the narrator's father in Obejas' short story poses the question "We left Cuba so you could dress like this?" to his daughter. Furthermore, socioeconomic status also plays an important role in the experiences of Cuban political exiles who were forced to renounce their wealth and status to the new communist government which led Lourdes and the father in Obejas' story to resent Cuba and communism. Consequently, they idolized the American Dream hoping it could grant them success and a sense of control. Generational differences between them and their children also created further challenges in addition to their struggles to assimilate and make sense of their Cuban identity as political exiles in the United States. This helps us to better understand the impact of the Cuban revolution on Cuban exiles, and the experiences of exile as a whole.

Julisa Porcayo

Dr. Ana Roncero-Bellido

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CONCURRENT SESSION 2

2:15–3:15PM

AS-150-A

123 Investigation of Optoelectronic and Thermal Properties of PANI/MOF Composite Materials

Undergraduate Student Project in Natural Sciences

In recent years, Metal-Organic Frameworks (MOFs) have become highly regarded for their high porosity and versatile applications in gas storage, catalysis, and water purification. However, the metal nodes within MOFs endow insulating properties to the material and inhibit charge transfer efficiency. Conductive organic polymers like polyaniline (PANI) are often introduced to MOFs to improve charge transfer efficiency. PANI is frequently integrated through an in-situ synthesis from the monomer, but there are competing interactions due to the reductive nature of the MOFs during synthesis. Recently, a novel synthetic approach that allows for a Michaelson addition reaction of the framework onto the PANI structure has been developed by our research group to create novel polymer composite materials. Thin films of these polymer composites were engineered through self-assisted evaporation onto glass substrates or covalent attachment to graphite. The photoelectronic properties of the composites were investigated using a custom-designed instrument built to simulate sunlight and specific wavelengths of light. Bandgap measurements were investigated using UV/Vis Reflectance Spectroscopy. Heat was introduced into the system to examine the relationship between heat and photoelectronic properties. The study of optical and thermal influence on electrical properties of MOF-based systems encourages further exploration into usage for the creation of polymer composite materials.

Johan Gonzalez

Contributors: Nathan Hajek, Adam Makhlouf, Leondardo Ramos

Dr. Daniel Kissel

132 Thermodynamic Analysis of MOF Thin-Layer Formation via Anodic Dissolution

Graduate Student Project in Nursing & Health Professions

Brother Bernard Rapp Research Fellowship and Research Focus Award

Metal-Organic Frameworks (MOFs) are a class of crystalline materials composed of metal ions clusters coordinated to organic linkers, creating potential void space. These materials have potential in several different applications due to their exceptional surface area, tunable pore sizes, and chemical versatility. Recently, MOFs have been explored in various industrial applications including gas storage, separation, catalysis, and drug delivery. MOFs can be synthesized by a variety of methods, depending on their applications. Anodic dissolution is a particularly attractive option for thin-layer synthesis as it is quicker and milder compared with other methods. In anodic dissolution, an oxidation current is applied to a pure metal anode to generate metals ions in solution that coordinate to an organic ligand at the metal-solution interface to form the secondary building unit (SBU). This study presents a thermodynamic analysis of MOF formation via anodic dissolution in an effort to better understand parameters that influence the process. A systematic investigation using different synthesis variables, such as applied voltage, ligand concentration, temperature, solvent system and metal reduction potential, was performed to determine how these variables control product outcomes. Electrochemical studies were carried out to confirm the accuracy of this analysis in predicting the necessary voltage to initiate formation of four different MOFs (Cu-BTC, Cu-BDC, Zn-BTC and Zn-BDC, where BDC = 1,4-Benzenedicarboxylic Acid and BTC = 1,3,5-Benzeneticarboxylic Acid).

Adan Martinez

Dr. Daniel Kissel

146 Preliminary Lifetime Measurements of Low-Lying Excited States of Ruthenium 94

Graduate Student Project in Natural Sciences

In any experiment, any scientist must be able to know as much as possible about their detector system. As such in this work, the Jurogam 3 high-purity germanium (HPGe) array at the Accelerator Laboratory of University of Jyväskylä (JYFL), Finland has been characterized for analyzing a lifetime experiment. Specifically, using data from standard radioactive sources (133Ba and 152Eu) an efficiency calibration, energy calibration, and gain matching was performed for the entire detector array. These calibrations are critical for ensuring that the data collected for the lifetime measurements are properly sorted, leading to data that can be accurately analyzed. The characterization parameters from this work will later be used to experimentally validate the known lifetime values of low-lying excited states of 94Ru, while additionally obtaining values for unknown lifetimes. The γ-rays were measured by the Jurogam 3 germanium detector array and Differential Plunger for Unbound States (DPUNS) plunger device, to measure lifetimes using Recoil Distance Doppler Shift (RDDS) analysis. Preliminary values for the lifetime values were calculated using previously obtained characterization parameters.

Joseph Koenig

Dr. Ryan Hooper

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CONCURRENT SESSION 2

2:15–3:15PM

AS-155-A

13 Lost in Translation: Differentiating Language Disorders from Emergent Language in Bilingual Students

Graduate Student Project in Nursing & Health Professions

In recent years, there is a rise in bilingual students who are enrolled in the American public school system. This exposed a critical issue in the field of speech-language pathology. There is an increased prevalence of over- and under- identification of bilingual students for speech therapy services. Research Questions: (1) How do SLPs differentiate bilingual students with a developmental language disorder from an emergent language learner? (2) How do perspectives of SLPs influence the differentiation process of bilingual students? ERIC, PubMed, and CINAHL were utilized using keywords: language disorder, bilingual/ multilingual, identification, detection, screening, recognition, assessment, and children. Articles were subject to a full-text review by the following conditions (1) relatability to the research questions, (2) measurements used to aid in identification, and (3) key findings from the studies. The literature search yielded 398 articles with the removal of duplicates. A total of 20 articles best represented the scoping review. It revealed the majority of SLPs utilized formal assessment scores in conjunction with parental and teacher reports to determine bilingual students' performances. In addition to formal measures, half of the articles suggested the use of informal language samples to aid in the identification. This scoping review revealed limited access to equitable services to bilingual students due to the lack of bilingual SLPs and multilingual materials. Future direction of stemming from this review should highlight the importance of creating multilingual standardized assessments, increase outsourcing of bilingual SLPs, and setting accurate and ethical standards to assess bilingual students.

Kelsey Calasanz

Dr. Karen Czarnik, Dr. Ann Guernon

100 Navigating Service Provision and Community Perceptions in a Suburban Environment: A Study of Homeless Service Nonprofits

Undergraduate Student Project in Education & Social Sciences

Summer Undergraduate Research Experience (SURE)

Nonprofit organizations are responsible for providing the majority of services to individuals experiencing homelessness. Despite a national increase in suburban poverty, much of previous research examines homeless service provision in urban areas. Suburban nonprofits may face different political and social environments such as local politics and community views of homelessness, which influence service provision in the suburbs. This qualitative case study examines the role of homeless service nonprofits in two suburban counties in Illinois, providing an opportunity to identify variation within the state. We have completed 15 interviews with nonprofit managers about how they understand homelessness and how they sustain support within suburban communities. We used initial themes from transcripts to develop a more in-depth coding scheme, which we used to analyze commonalities, differences, and intersections of themes. This presentation will discuss findings related to two themes, barriers to services and challenges for clients. Barriers to services involve limited affordable housing for clients, limited and mismatched resources, and difficulty with collaborating with other organizations. Challenges for clients involve economic problems, difficulties obtaining or maintaining employment, and prejudice or discrimination amongst landlords. These two themes often interact with one another, making it challenging for homeless service providers to address the challenges that clients face and help clients find housing. This research can help address the issues that make ending homelessness in the suburbs a more difficult task and educate communities, funders, and elected officials on these hardships so they can better assist nonprofits and their clients to be successful.

Raven Robinson

Dr. Rachel Wells

130 Cognitive Calm: The Power of Prayer, Affirmations, and Mindfulness on Cognitive Stress and Attention as Measured by EEG

Undergraduate Student Project in Education & Social Sciences

Although previous research has examined prayer and meditation separately, fewer studies have directly compared secular and religious self-help interventions. This study investigated the immediate effects of short-term, audio-based self-help interventions on cognitive performance. Electroencephalogram (EEG) technology was used to measure brainwave activity associated with attention and cognitive stress. Participants first completed a computerized working memory task (N-Back) while EEG recordings measured baseline attention and cognitive performance. They were then assigned to one of four intervention groups: prayer, positive affirmations, breathing mindfulness meditation, or a control condition (audiobook reading). Following the intervention, participants completed the N-Back task again, and pretest-posttest changes in attentiveness and cognitive stress, as measured by EEG and N-Back scores, were analyzed. Researchers also examined whether brainwave measures of interest, engagement, and relaxation recorded during the interventions predicted greater pretest-posttest differences. Additionally, participants completed a self-report survey assessing demographic and psychological variables, which were analyzed as potential moderators of posttest cognitive performance outcomes.

Hannah Herr, Danielle Gorman, Annabelle Makselan

Dr. Matthew Domico

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CONCURRENT SESSION 2

2:15–3:15PM

AS-156-A

21 Portfolio Manager Ratings: k-Means and LDA Versus Active Outperformance

Graduate Student Project in Business

This study evaluates key metrics in active portfolio management, including alpha, beta, tracking error, and the information ratio (IR), to assess investment strategies' performance against benchmarks. The research incorporates machine learning models, such as k-Means clustering and Linear Discriminant Analysis (LDA), to enhance traditional classification schemes and improve decision-making. Data from Yahoo Finance and Morningstar ratings are analyzed to compare risk-adjusted returns across various asset classes, including fixed income, equities, and hedge funds. Regression models and machine learning techniques help identify factors influencing portfolio success, providing insights into whether active management adds value beyond market exposure. The study highlights the potential of data-driven approaches to optimize investment strategy evaluation and mitigate biases in advisory ratings.

Swathi Muddangula

Dr. Apostolos Xanthopoulos

124 Team Coaching

Graduate Student Project in Business

The purpose of my paper was to explore Team Coaching. I selected the topic of Team Coaching because it is a fairly new form of coaching and I wanted to learn more about it. Additionally, my organization is exploring Team Coaching and is testing the concept.

I explored Team Coaching through a thorough literature review and review of the International Coaching Federation's website. My research focused on defining team coaching, identifying the benefits of team coaching and the ethics of team coaching along with exploring team coaching competencies. The result of my work was a more thorough understanding of team coaching. Team coaching is becoming a key intervention to help leadership and executive teams thrive for the good of the organization. My research focused on defining team coaching, identifying the benefits of team coaching and the ethics of team coaching along with exploring team coaching competencies. My work informs others of team coaching and builds an understanding of the benefits of team coaching and when to use team coaching.

With the emphasis on teams within organizations and the focus on organizational growth and productivity, team coaching is becoming a key intervention to help leadership and executive teams thrive for the good of the organization.

Laura Weinreb

Dr. Michael Cherry

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2:15–3:15PM

AS-157-A

145 Senior Seminar in English Studies

Undergraduate Student Project in Humanities & Communication

This panel presents the research and creative writing projects of the members of the Senior Seminar in English Studies in Fall 2024. Students will present their capstone projects for the Bachelor's Degree in English Studies. Students conduct their course of study for the English BA in one of three concentrations: English Language Arts, Language and Literature, and Writing. The titles of each project to be presented is listed below. -Lama Abdelhamid--On Feminism: The Secondary Female in the Gothic -Molly Gustafson--"Like Petal to Steel"-an anthology of poems -Liam Jarot--An Analysis of Martin Scorsese's The Last Temptation of Christ and Mike Flanagan's Midnight Mass -Hannah Smrcka--Approaching Shakespeare's Coriolanus with Subaltern Theory and Disability Studies -Tess Spacil--Teaching Flannery O'Connor and Disability Studies to Secondary Students -Lauren Raimbault--Ruins: The Crimson Vale: the Beginning of a Video Game -Stephanie Jimenez--Teaching Feminist Theory to Secondary Students Through Jane Eyre .

Lama Abdelhamid, Molly Gustafson, Liam Jarot, Hannah Tuback, Tess Spacil, Hannah Smrcka, Lauren Raimbault, Stephanie Jimenez

Dr. Christopher Wielgos

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CONCURRENT SESSION 3

3:30–4:30PM

AS-150-A

20 Microbial Activity of Rhizosphere in Soils Amended with Biochar Produced from Different Species of Invasive Plants

Undergraduate Student Project in Natural Sciences

Summer Undergraduate Research Experience (SURE)

Biochar is a carbon rich substance made from plant biomass combusted in the presence of limited oxygen and can be applied as a soil amendment to improve the quality degraded soil. This research examined the microbial activity in soils amended with biochar produced from the leaves of invasive plants. The hypothesis is that microbial activity will vary due to the source of biochar. Biochar produced from different invasive plants, was mixed with soil collected from the Lewis University campus and the mixtures were used to grow lettuce and cilantro in planting trays over the course of eleven weeks. The plants were separated from the soil, and soil samples from each treatment were collected for analysis. Dilutions were prepared and used to inoculate EcoPlates. Absorbance measurements were recorded daily over seven days. The metrics used to analyze microbial activity included carbon richness, average well color density, Shannon diversity index, similarity index, Simpson diversity index, and Shannon Evenness index, which were calculated using the absorbance measurements. The results indicated that there was an increase in carbon richness and average well color density in treatments of cilantro grown in soil amended with biochar compared to unamended soils with cilantro. In addition, lettuce grown in soil without biochar amendments exhibited greater carbon richness and average well color density values. The conclusions are that biochar does not universally increase soil microbial activity, and the degree of change depends on the source of biochar as well as the crop planted in the amended soil.

Octavio Ortiz, Aidan Fisher

Dr. Jerry Kavouras

40 Investigation of Antimicrobial Molecules in Osage Orange *(Maclura Pomifera)* Extracts

Undergraduate Student Project in Natural Sciences

Doherty Center for Aviation and Health Research

Studies show that the natural products found in the fruit of the Osage orange tree *(Maclura pomifera)* exhibits antimicrobial properties. This group demonstrated that an extract prepared from the Osage orange fruit is effective in preventing the growth of Gram-positive and Gram-negative bacteria. The purpose of this ongoing study was to characterize the antimicrobial compound present in these extracts. In multiple attempts to heat inactivate the antimicrobial factor, extracts were subjected to various treatments, which included submersion for 20 minutes in a 65°C water bath, or 10 minutes in a 90°C water bath, or autoclaving the extract for 20 minutes. A freeze-thaw approach was also used to inactivate the extract, which included freezing at -80°C for 20 minutes, then submersion in a 65°C water bath for 20 minutes. Dialyzed extracts were prepared that excluded molecules less than 500 Daltons from the extract. Different concentrations of the dialyzed product and heat-treated extracts were prepared in sterile tryptic soy broth that were then inoculated with 100 µL of liquid bacterial cultures. After 18 hours of incubation at 37°C, the turbidity of the samples was measured. The results indicated that antimicrobial activity after heat inactivation remained. The results also indicated that longer periods of dialysis removed the antimicrobial factor from the extracts. It was concluded that the antimicrobial molecules in the Osage orange extracts are heat stable and less than 500 Daltons. Future work will focus on identifying the antimicrobial agent and testing it against clinically relevant strains of bacteria.

Maciej Zalinski, Ashley Miller, Ethan Brooks, Shaylin Roark

Contributor: Aine Ronan

Dr. Jerry Kavouras, Dr. James Rago

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CONCURRENT SESSION 3

3:30–4:30PM

AS-155-A

31 A Critical Examination of the Implementation of Multi-Tiered Systems of Support and the Impact of Race through the Lens of Critical Race Theory

Graduate Student Project in Education & Social Sciences

This research is an analysis and critique of the existing framework known as Multi-Tiered Systems of Support (MTSS). The focus is on how inadequate or lack of implementation of support systems adversely affects students of color, particularly by examining the disparities in the types of support these students receive and the current data around student achievement. This analysis aims to highlight the systemic factors and societal influences that contribute to unequal access to resources, explore the shortcomings in intervention strategies, and advocate for more equitable practices within the MTSS framework. By examining the intersection of race and education, this critique seeks to bring forward the inherent challenges that students of color face in accessing sufficient support and to propose solutions for implementing evidence-based and effective support systems with fidelity. The examination was conducted through the lens of Critical Race Theory, employing qualitative research methods to gain deep insights into the subject matter. A series of interviews were held with elementary school teachers, focusing on their current implementation of Multi-Tiered System of Supports (MTSS), their instructional practices, and the resources available within their schools. Additionally, the study will explore their perceptions regarding the existing achievement gap, particularly as it relates to students of color, aiming to uncover the challenges and opportunities within these educational dynamics. Interviews will be semi-structured with some guiding questions but leave room for open discussions to capture teacher perspectives.

I am conducting a comprehensive analysis of both current student achievement data and teacher perspectives on the Multi-Tiered System of Support (MTSS) as it is implemented within schools. My focus centers on the latest data extracted from the Illinois Report Card, which provides vital insights into student performance in Reading and Mathematics. This analysis pays particular attention to the disparities in achievement across various racial groups, revealing that race and the systems of support in place directly impact student achievement.

Furthermore, the data shows the significant influence of race on disciplinary actions within educational settings, highlighting a troubling correlation between these disciplinary measures and student achievement. As I dive deeper into these findings, it becomes increasingly clear that race not only impacts academic performance but also shapes the disciplinary framework within schools, ultimately affecting the educational experiences and successes of students.

By conducting a comprehensive analysis of the current data related to student achievement, assessing the existing implementation of the Multi-Tiered System of Supports (MTSS) within our schools, and gathering insights into teachers' perspectives on support systems, we can pinpoint specific areas for growth. This collaborative effort will enable us to craft a thoughtful and strategic plan for meaningful change.

Blanca Hipolito

Dr. Erica Davila

153 Reframing Multilingualism: A Transformative Justice Approach to Equity in Education

Graduate Student Project in Education & Social Sciences

This presentation explores the importance of recognizing multilingualism as an asset rather than a deficit in early childhood and K-12 education. As an immigrant, multilingual educator, and parent, I have witnessed the challenges multilingual students face in U.S. schools, where linguistic diversity is often perceived as a barrier to academic success. This deficit-based perspective leads to systemic inequities that limit opportunities for these students. By drawing on Souto-Manning's work, this presentation explores how Transformative Justice Education (TJE) can help recognize multilingualism as a valuable asset in schools. TJE promotes fairness, inclusion, and the removal of unfair policies that disadvantage students. This research looks at the history of negative attitudes toward multilingualism and examines four key TJE principles—Equity and Justice, Cultural Stability, Systemic Policy Reforms, and Inclusive Education—to show why multilingualism should be appreciated for its cognitive, social, and cultural benefits. It also highlights the unfair challenges that multilingual students and English learners (ELs) face, such as being placed in special education at higher rates, being denied access to advanced classes, and dealing with biased policies. Additionally, it critiques restrictive practices like English-only instruction and standardized testing, which often exclude multilingual students and overlook their unique strengths. Using Transformative Justice Education, I advocate for systemic transformation in education to ensure multilingual students are valued, supported, and empowered to succeed in ways that contribute to a more just and inclusive society.

Geeta Asher

Dr. Erica Davila

160 Examining the 21st Century Policing Task Force's Impact through a Cultural Competence and Critical Race Lens: "A Critical Analysis of Law Enforcement Training, Education and Police Discretion."

Graduate Student Project in Education & Social Sciences

This study critically analyzes the 21st Century Policing Task Force Report (2015) through the lens of Cultural Competence Theory (CCT) and Critical Race Theory (CRT) to explore the impact of education and training polices on policing practices. Specifically, it examines Pillar 5.11, which emphasizes higher education and cultural competence training as a major necessity for enhancing police discretion and improving community-police relations. While the Task Force aims to professionalize the field of law enforcement through incentivizing education, disparities in training access, systemic resistance and inconsistent implementation create challenges to reform efforts. Through Critical Policy Analysis (CPA), this research dismantles the language and power structures within the Task Force's recommendations, locating the gaps between the intent of the policy and real-world application. The analyzation of police training manuals, policy documents and academic literature will provide an understanding into how institutional barriers, implicit biases and funding disparities induce police education and discretion. The findings will contribute to ongoing discourse centering around the effectiveness of cultural competence training in law enforcement and the wide-range implications towards fairer policing outcomes. This research highlights the importance of standardizing training, firmer accountability measures and the integration of cultural awareness in police education. By bridging the gap between policy recommendations and implementation, this research goal is to direct future reform efforts towards meaningful methods of enhancement for police-community relations and professional accountability in modern law enforcement.

Angela Patterson

Dr. Erica Davila,
Dr. Morris Jenkins

THURSDAY • APRIL 24

CONCURRENT SESSION 3

3:30–4:30PM

AS-156-A

18 Real-Time Phishing Detection and Preventive Education System

Graduate Student Project in Engineering, Computer Science, and Mathematics

Phishing attacks trick people into revealing sensitive information like passwords and financial details, leading to major security risks. Many users fall victim to these scams because they don't know how to recognize them or don't have tools to detect them. This project introduces a Real-Time Phishing Detection and Preventive Education System, which helps users identify phishing threats instantly while teaching them how to avoid future attacks. The system will use smart technology to scan emails, links, and messages for suspicious signs and provide immediate alerts. Additionally, an interactive learning feature will guide users through real-world phishing scenarios, helping them build skills to recognize scams before they become victims. By combining real-time security with preventive education, this system aims to strengthen cybersecurity awareness and reduce phishing-related risks. This research provides a practical solution for staying safe online in an increasingly digital world.

Hajira Sultana

Dr. Rami Khasawneh

23 CryptoLearnNest - Cybersecurity Awareness Mobile Web Application

Graduate Student Project in Engineering, Computer Science, and Mathematics

CryptoLearnNest is a web-based mobile application designed to address the critical cybersecurity awareness gap among non-technical internet users. The platform tackles prevalent security challenges by providing interactive, accessible educational content focused on three key areas: safe browsing practices, password security, and phishing detection. the application offers structured curriculum, hands-on exercises, and real-time feedback to empower users with essential cybersecurity skills. By delivering engaging learning modules and scenario-based assessments, CryptoLearnNest aims to reduce cyber attack incidents and enhance personal data protection through targeted digital security education.

Nithin Rao

Dr. Rami Khasawneh

111 InterviewEdge: A Smart Technical Interview Simulator

Graduate Student Project in Engineering, Computer Science, and Mathematics

Traditional interview preparation lacks real-time feedback, adaptability, and interactive assessments, leaving candidates unprepared for high-stakes technical interviews. InterviewEdge is a next-generation technical interview simulation platform that combines dynamic coding challenges, AI-powered evaluation, and real-time speech analysis to refine problem-solving and communication skills—key aspects of modern hiring assessments. InterviewEdge is built using Next.js, Node.js, and MongoDB, integrating AI-driven evaluation models to provide instant, structured feedback on coding correctness, efficiency, and structure. Beyond technical assessments, the platform also analyzes behavioral responses via speech-to-text processing, evaluating clarity, articulation, and storytelling using industry-aligned best practices. Unlike conventional platforms, InterviewEdge gamifies the learning experience through leaderboards, adaptive difficulty scaling, and real-time performance analytics to keep users engaged. Preliminary testing indicates that users improve interview performance 2x faster compared to passive study methods. AI-powered feedback allows candidates to iterate on their mistakes instantly, reinforcing best practices in coding and behavioral interview techniques. Company-specific question sets mimic FAANG and startup hiring trends, offering a realistic preparation experience. InterviewEdge revolutionizes technical interview training by combining AI-driven assessment, gamification, and personalized analytics into a seamless, interactive experience. By offering real-time feedback on both coding and behavioral responses, it eliminates blind spots, accelerates learning, and maximizes success rates in competitive job markets.

Salavuddin Shaik

Mr. Ziad Al-Sharif

THURSDAY • APRIL 24

CONCURRENT SESSION 3

3:30–4:30PM

AS-157-A

149 Shakespeare and Disability

Undergraduate Student Project in Humanities & Communication

This roundtable discussion grows out of a semester of studying the intersection of Shakespeare's plays and early modern understandings of corporeal and cognitive disability. Drawing upon a set of primary and secondary texts, discussants explore representations of disability in Richard III, Hamlet, and Coriolanus, and disability history and theory in the work of leading disability scholars David Houston Wood, Alison P. Hobgood, Alice Equestri, and Tobin Siebers.

Kate Goranson, Tara Quinlan, Liam Jarot, Hannah Tubacki, Jimena Araiza, Madison Glaum, Molly Gustafson

Dr. Mardy Philippian

POSTER SESSION A

THURSDAY • APRIL 24

1–2PM

FIELDHOUSE

1A A Mathematical Model of *C. difficile* Transmission and Control in Healthcare Settings

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Summer Undergraduate Research Experience (SURE)

Clostridioides difficile, also known as *C. difficile*, has been the leading cause of infectious diarrhea and one of the most commonly-obtained infections in United States hospitals with nearly a half million cases recorded each year. Those infected could have contracted a *C. difficile* infection (CDI) due to interactions with a surface or person harboring the spores spread by this bacteria. Patients with a CDI spread endospores which have been proven to be difficult to remove from the hospital environment, so these patients are sometimes placed into an isolation room. Previous mathematical models have only considered patients' interactions with the environment and have not evaluated the effect of hospital employees or the isolation of infected individuals. This work developed a system of ordinary differential equations to examine the impact of different transmission routes such as healthcare workers, doctors, and low- and high-touch frequency fomites, objects likely to carry infection, on the spread of *C. difficile* in a hospital setting. This model is also one of the first to consider an isolation class for patients with a CDI. Results show an emphasis on increased hand hygiene of hospital staff as well as the application of isolation protocols as the most effective strategies to minimize incidence within a hospital ward. Healthcare professionals can apply these and other findings to help mitigate the spread of *C. difficile* in healthcare settings.

Kristen Ess

Dr. Cara Sulyok

4A Adsorptive and Electrochemical Methods for Water Reclamation in Chemical Mechanical Planarization (CMP) Processes

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Water conservation, remediation, and reuse have become critical in semiconductor manufacturing processes as integrated circuit technology advances. Chemical Mechanical Planarization (CMP) is a crucial step in semiconductor manufacturing that achieves defect-free planarization on device architecture. This process requires large volumes of water that are ultimately polluted with a complex mixture of abrasive nanoparticles, organic material, chemical additives, and post-processing substrate effluent (e.g., Cu, W, TEOS, SiC, Mo, etc.). The industry has used several filtration and coagulation methods; however, they face inefficiencies due to the complex reactive nature of CMP wastewater. This work proposes various approaches to improve current remediation pathways, including electrochemical and adsorptive techniques for wastewater treatment, particularly highlighting potential redox-active biopolymeric filtration media and electrowinning. TiO2 nanoparticles (NPs) have exhibited the capability to act as photocatalysts for redox activity due to their wide bandgap and high surface area. These NPs are considered nontoxic, making them a good candidate for use in sustainable materials. Several methylene blue removal studies were conducted to determine the adsorption kinetics of cellulose acetate beads. TiO2 NPs were integrated into cellulose acetate beads and the photocatalytic degradation of methylene blue was analyzed using scanning electron microscopy and energy dispersive spectroscopy. Efficiency of electrowinning was assessed through slurries of various compositions, and analyzed using several analytical techniques like spectroscopic analysis, selective ion probing, and electrochemical analysis.

Angelina Martinez

Contributor: Rebecca S. Ratajczck

Dr. Jason Keleher

7A An Analysis of MLB Barrels, What Factors are Most Important?

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Some baseball stadiums are known to be more friendly to hitters by the high home run counts due to elevation, weather, and stadium geometry. This research uses statistical tools in order to investigate whether weather factors like temperature, humidity, and elevation contribute to MLB ballparks being more or less friendly to hitters. In particular, we will explore whether these factors impact the probability of a barrel also being a home run.

Ryan Manikowski

Dr. Amanda Harsy, Dr. Kitty Yang

10A Development of a Heating Pad for Sedated Animals

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Veterinarians often need to put pets under anesthesia, but while the animals are unconscious they end up losing body heat quickly. To combat this, veterinarians will use heating pads or other means to warm up their bodies, but current heating pads vary by 10°F. This fluctuation in the temperature may pose a risk in maintaining the vitals in an animal. The ideal body temperature for most pets is around 100°F but they can lose up to 8°F when they are anesthetized. As the temperature of the animal drops, the body organs fail to function properly. This device aims to maintain a range from 96-100°F to keep the body temperature of the animal close to the ideal temperature. The heating pad will be 28 by 20 inches, and an Arduino is going to monitor the system. The final goal of this project is to monitor and control the device via Bluetooth.

Adrian Guzman

Dr. Philip Chumbley

13A Development of a Low-Cost 3D Model of Static Light Scattering

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Light scattering can be used to determine the size of particles in a substance, which is of much interest to the pharmaceutical and food industries. For example, the size of a drug particle can affect its absorption rate by the user, while the size of a food ingredient can determine the texture of its byproduct. The problem with this technique is that it requires research-grade equipment that costs thousands of dollars. The goal of this project is to develop a low-cost light scattering apparatus using Arduino-based sensors, 3D printed components, and low-cost lasers. A preliminary study has shown that the measurement of polarized light scattering by skim milk samples with this device is comparable to literature. In the next phase of testing, we are measuring the polarized light scattering amplitude vs particle size and the polarized light scattering amplitude vs solution concentration for various particle sizes. This investigation will determine whether the low-cost equipment is sensitive enough to determine particle radius. Furthermore, the team is currently testing data repeatability across different versions of the same low-cost device, while changing button commands and implementing liquid crystal displays for a more user-friendly experience. Ultimately, these efforts will make light scattering research more accessible to young students and possibly spark their interest in the optics field of study.

Enzo Ribeiro

Contributors: Alexis Bibian, Adrian Guzman, Michael Vargas, Justyce Watson

Dr. Joseph Kozminski

16A Development of a Low-cost, Modular Weather Station to Aid in Environmental Data Collection and Air Quality Research

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

This project aims to develop a modular, low-cost weather station capable of continuously tracking ambient temperature and humidity, wind speed, and wind velocity. Knowledge of these parameters is critical in predicting the spread and concentration of contaminants, which has significant implications for public health and environmental protection. The weather station itself is Arduino-based and utilizes open-source hardware and software to measure the aforementioned parameters. Environmental data is recorded at regular intervals and saved to the device's on-board storage or transmitted wirelessly for real-time data monitoring. In addition to measuring accurate data, the station's design lends itself to a significant degree of modularity, such that additional sensors for measuring other parameters (such as barometric pressure) can be added with relative ease. Lastly, the weather station is low-cost and easily reproducible, such that multiple stations can be assembled and placed at various existing air-quality monitoring sites in the Romeoville area, expanding the scope of the current environmental monitoring operation.

Edward Savant

Dr. Joseph Kozminski

19A Development of Agent-Based Models for Evaluation of Precision Nutrition Interventions Through a Socioeconomic Lens

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Summer Undergraduate Research Experience (SURE)

Precision nutrition tailors dietary recommendations at the individual level, rather than applying generalized guidelines. On a larger scale, it enables targeted interventions that address community health needs. This project uses an agent-based model (ABM) to simulate the overall health dynamics of Broadview, Ill., evaluating how socioeconomic factors and access to resources influence overall well-being. The model simulates Broadview residents with demographics and characteristics taken from the U.S. Census and government data. Residents make daily decisions based upon probabilities that are influenced by socioeconomic status, health conditions, and access to resources. Each agent has a health score determined and updated by their decisions. These scores are aggregated into a total population health score, allowing us to gauge the overall health of the community and test intervention strategies. Our model utilizes stochastic decision-making to simulate the randomness of human behavior. By considering various intervention strategies, we can evaluate their effects on both individual and community health. This study aims to identify the relationships between socioeconomic status, daily interactions, and access to resources in shaping overall health. Through simulations, we can determine effective strategies to improve public health in Broadview, particularly for underserved populations. The results can inform policymakers and public health officials to implement interventions that increase community health.

Zachary Campbell, Chuckie Gentile, Claire Levis

Contributors: Nuvia Hernandez, Brandon Kemp, Austin Kind, Matthew Senese, Emilio Vilchis, Mackenzie Welsh

Dr. Brittany Stephenson, Dr. Cara Sulyok

22A Dye Adsorption as an Empirical Method for Optimizing Sorbent Regeneration

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

The textile industry is the second largest pollutant in the world. One of its contributions to polluting the environment is dumping harmful wastewater full of toxins without going through a purification process. Different carbon structures have been developed to remove these toxins, such as dye, out of the wastewater. This project focuses on two different structures: Powder Activated Carbon (PAC) and Hierarchically Porous Carbon (HPC). These samples are tested by adsorbing methylene blue (MB) dye from diluted MB dye samples for various time increments. To refrain from contributing to the problem of pollution, two methods of fully saturated carbon regeneration are tested: thermal and microwave. Preliminary data is collected on regeneration, not providing concrete conclusions as it is an ongoing project. As for the two structures, the HPCs outperformed the PACs by removing more dye from the samples and also removing the dye at a faster rate.

Emily Lindemann

Contributor: Helen Brzozoski

Dr. Luis Estevez, Dr. Kenya Crosson, Dr. Garry Crosson

25A ECAMS Billboard Kiosk

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

The ECaMS Billboard addresses the immediate need for a platform that provides students with up-to-date information about on-campus events, faculty contacts, and essential resources. We aim to enable students to be well-informed and actively engaged in campus life. Strategically located on campus, the Billboard provides information about campus events and allows retrieval and submission of event posters. Students can view and submit announcements about campus events, access a directory of ECaMS faculty with contact details and office hours, and use a QR code to link to a mobile app with various tools like campus resources. Initial implementation of the kiosk indicates a positive reception from students, who appreciate the access to information. Preliminary data shows high engagement with event flyers and faculty contact information. The ECaMS Billboard Kiosk is a smart and efficient solution that meets the university community's immediate needs. It fosters an involved and informed student body through a single accessible platform. With this, we can maximize validated learning about students' needs and preferences with minimal development effort, paving the way to utilize this technology throughout the campus rather than a single system in the arts and science building.

Noah VanGorp, Samuel Swedo, Anthony Missana

Contributors: Johan Olmos Zavala, Gabe Carlson, Justin Cordero, Ryan Hinkle, Ryan Szostak

Eric Pogue

28 Impartial Geodetic Building Games On Graphs

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Summer Undergraduate Research Experience (SURE)

An impartial game is a 2-player game that consists of a finite set of positions in which the possible moves are the same for each player at any position. In this research, we explore winning strategies for a geodetic achievement game originally defined by Buckley and Harary. The games are played such that players take turns selecting previously unselected vertices of a graph until the set of selected vertices satisfies our geodetic conditions. To win the achievement game, a player must choose a vertex such that the selected vertex set generates all vertices of the graph. We will explore this impartial geodetic game on various graph families such as a cycle graph with rays.

Evan Burns

Dr. Marie Meyer

31A LewisCal

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Lewis University is currently the 8th largest private university in Illinois with around 6.5K enrolled students. Our project is a tool designed to help those students and staff efficiently organize their schedules by entering the course's details. They enter course information such as class times, locations, and instructors. Our product subsequently allows users to generate an iCalendar (.ics) formatted file which can be imported across widely used calendar applications like Google Calendar.

We use Microsoft Azure to host our product, allowing for scalability and reliability. GitHub is utilized for CI/CD (Continuous Integration and Continuous Deployment) to maintain an efficient development pipeline. The front-end is built using React, providing a responsive and user-friendly interface. Additionally, we integrate TailwindCSS for styling.

This product will make it easy for teachers to distribute an accurate calendar that students can quickly download and use without any issues. This will also make it easy for the teacher to update the schedule, in the case that they need to make a change on their end, such as

missing a few days of class, they can quickly change it on their end and then send the new file to students with the newly corrected dates for class. Visit us at *www.lewiscal.azurewebsites.net* . Feedback is greatly appreciated.

Jason Yescas, Matthew Shouse, Nikhila Gonuguntla

Contributors: Mateusz Obrochta, Matthew Bilinski, Ivan Sanchez.

Eric Pogue

34A Mathematical Models of Disease Transmission and Control in Hospitals and Local Communities

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Doherty Center for Aviation and Health Research

This project investigates the effects of both hospital and community transmission of *Clostridioides difficile (C. difficile)* using an agent-based model (ABM) to determine optimal strategies for mitigating the spread of this bacteria. While *C. difficile* remains one of the most common causes of healthcare-associated infections in the United States, data from the Emerging Infections Program at the Centers for Disease Control and Prevention has shown a decrease in the overall burden of *C. difficile* in healthcare settings from 2011 to 2017. During that same time period, no such decrease occurred in community-associated infection, which accounted for nearly 50% of the burden of *C. difficile* infections (CDIs) in 2017. Many mathematical models have been developed to understand *C. difficile* transmission in healthcare settings, but there has been a noticeable absence of models to understand its spread in communities, especially with a focus on what could lead to a CDI outbreak. ABMs consider the individual behaviors of system components by defining a set of rules that govern how individuals interact on a spatial grid. These types of models rely heavily on probabilities, which allow for the randomness of individual decision-making to be simulated. In developing and analyzing an ABM, we will help pinpoint the origin and main causes of a CDI outbreak within hospitals and communities as well as methods to eliminate or reduce the potential spread of the bacteria.

Zachary Littell

Dr. Cara Sulyok, Dr. Brittany Stephenson

37A Optimal Strategies for Vaccinating Against COVID-19

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Summer Undergraduate Research Experience (SURE)

The COVID-19 pandemic helped to show how quickly the entire world could be shut down and reshape our global society. Disregarding any political views or effectiveness of the virus, we have examined an optimal vaccination rate with regards to cost and availability of distribution in order to be better prepared and protect more people should another outbreak similar to COVID-19 occur. Through the use of optimal control theory, the process of optimizing a dynamic variable through parameterized function known as an objective functional, the model contains a time-varying optimal vaccination rate that minimizes both disease prevalence as well as the "costs" associated with vaccination. In this case, "cost" is a broad term considering time, money, and effort to vaccinate. In our findings, we share how varying the different vaccination parameters resulted in multiple visual patterns within the vaccination rate as well as the overall model.

Jacob Prince

Dr. Brittany Stephenson, Dr. Cara Sulyok

40A Optimizing Audio-Input Devices in an Arduino-Based Speech-to-Text Glasses

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

According to the World Health Organization, hearing loss affects approximately 1.5 billion people worldwide—nearly 20% of the global population, with around 15% of adults over 18 experiencing some degree of hearing difficulty. Many of these individuals do not qualify for hearing aids under insurance policies according to the NCOA (National Council on Aging), and they continue to have auditory problems in day to day life in situations such as sitting through lectures or even one on one conversations. This project focuses on developing an Arduino-based live subtitling device that projects real-time speech-to-text onto a glasses-mounted lens. Using optics principles, text from an audio input device that projects onto a mini screen, ensuring optimal visibility without obstructing the wearer's field of vision. Given that there are competing devices in the market, this project aims to identify the most accurate and efficient audio input device for speech-to-text conversion. Various commercial solutions, including Bluetooth-enabled microphones connected to Arduino via iPhone integration or alternative microphone setups, will be explored to optimize performance in terms of both accuracy and speed.

Alexa Kemp

Dr. Philip Chumbley

43A Power and Protection: Hardening Infrastructure Security of the U.S. Energy Sector

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Many elements go into the cybersecurity of the energy sector of our critical infrastructure. The importance of understanding and finding new ways to circumvent rising threats cannot be overstated. This project is the collection of past incidents, current operations, with the purpose of developing new and effective approaches to cybersecurity in the future. Cyber attacks have been composed of groups attacking suppliers/service providers of energy and exploiting a strategic weakness in the energy sector supply chain, most notably the Colonial Pipeline cyberattack (2021) carried out by a hacker group called DarkSide which was possible because of a compromised password. Attacks like these compromise operations and magnify weak points. Cyber attack groups hold companies for ransom to demand large amounts of money in exchange for the return of their company operations. Innovative cyberattacks will always be an issue. Current CISA (Cybersecurity & Infrastructure Agency) operations have been fairly ironclad, but technology is on the exponential incline and in April of 2024 a Texas energy company faced a breach from pro-Russian hacktivists. Current research and methods implemented to mitigate the lateral progression for potential future attacks could include the implementation of Multi-Factor-Authentication (MFA), but more robust measures need to be taken. Effective approaches in the future could include stronger cybersecurity protocols overall and more effort put into training personnel. Assessing existing cyber security practices within the energy sector would greatly assist in the imperative task of developing better security overall for the rapidly approaching future.

Caleb Harper, Emiliano Solis, Mackenzie Deleon, Anthony Mitchell

Dr. Matt Plass

46A Preimages of Shuffle Sorting Algorithms

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Semester Math Research MATH 470

A Sorting Algorithm is an algorithm which, after a finite number of iterations, completely sorts its input. For us, inputs are a collection of numbers and they are considered completely sorted when they are placed in increasing order. The preimage of a fixed ordering of numbers is the collection of all orderings of numbers which, after one iteration of the algorithm, output the fixed order of numbers. The study of preimages of sorting algorithms has recently given rise to a rich story that varies greatly between algorithms. Early work studied when preimages of sorting algorithms gave way to certain patterns. More recent studies have provided insight into the number of preimages of a given ordering of numbers under a stack sorting algorithm, as well as a more global study of the graph structure of sorting algorithms in Queuesort algorithms and the Bubblesort algorithm. In this work, we begin the study of preimages under certain so-called shuffle sorting algorithms which were recently introduced by Pudwell and Smith, named PRE, MIN, PRE-REV and MIN-REV. We wrote code to implement these sorting algorithms and then used this code to print graphics which displayed all orderings of a given set of numbers and how the sorting algorithms acted on them. With these graphics, we were able to derive patterns and prove that those patterns hold in general. For each of these new algorithms, we provide key characterizations of their preimages, extending the work which has been done on classical sorting algorithms.

Kacper Zalewski, Diego Velasco, Robin Pobanz-Pawlak

Dr. Adam Schultze

49A QuizMaster

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

The work that will be presented is a website called QuizMaster. It is a Lewis University student-made website that can help students prepare for tests and quizzes in their classes. The website has pre-made quizzes for various

subjects that students can take, and students can create their own quizzes. The QuizMaster team is working to make the website even better than it is now. There are ideas to give students the ability to make flashcards, different question types, and to give teachers the ability to upload their quizzes to help students practice or study. The website is updated consistently with new updates to improve the user experience as much as possible. QuizMaster's goal is to become a great study option for students that teachers can recommend. With all the tools available for students to make use of QuizMaster is a great study tool for students by students.

Demetrius Price, Nuvia Hernandez, Sami Alzoubi, Erick Ezzepeda
Contributors: Daniel Jazowski, Brian Gutt, Jayrell Garcia, Ahmad Yousuf, Hima Madhavan

Eric Pogue

52A Syllabye

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Syllabye is a web platform designed to streamline the syllabus-sharing process for both students and faculty at Lewis University. Our goal is to simplify syllabus creation for professors by providing an intuitive, university-specific template that ensures consistency across all courses. Using technologies such as React, JavaScript, CSS, Bootstrap, Firebase, and Microsoft Azure, we have built a robust and scalable solution. Syllabye aims to be the university's standard for syllabi creation and viewing. Please note that Syllabye is in its early stages of development but will be ready in time for our presentation. Link to site: *https://gentle-moss-0fd314310.4.azurestaticapps.net/*

Nicholas Krzysiak, Irving Sanchez, Jaiden Leonard, Bryan Avalos

Eric Pogue

55A Tile-based Graph Theoretical Modeling of Self-Assembling DNA of the Kayak Paddle Graphs

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Self-assembly is a term used to describe the process of a collection of components combining to form an organized structure without external direction. The unique properties of double-stranded DNA molecules make DNA a valuable structural material with which to form nanostructures, and the field of DNA nanotechnology is largely based on this premise. By modeling nanostructures with discrete graphs, efficient DNA self-assembly becomes a mathematical puzzle. These nanostructures have wide-ranging applications, such as containers for the transport and release of nano-cargos, templates for the controlled growth of nano-objects, and in drug-delivery methods. This research project centers around exploring graph theoretical and combinatorial properties of DNA self-assembly to optimize the nanostructure construction for laboratories. This poster shares our results in determining optimal design strategies for the Kayak Paddle Graph Family.

Molly Paez

Dr. Amanda Harsy

58A T-Mobile Telecommunications Breach

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

State-sponsored cyber attacks pose a significant threat to national security, and the communications sector is one of the most exposed areas of contemporary infrastructure. This research analyzes the T-Mobile attack and its implications on various telecom operators, such as Verizon, AT&T, and Lumen Technologies, by the Chinese state-sponsored hacking group, Salt Typhoon. Within an eight-month timeframe, Salt Typhoon hacked law enforcement surveillance software, gaining access to call histories, unencrypted SMS messages, and voice calls without proper permission (Mascellino, 2024). Using zero-day exploits and other intelligence-gathering techniques the attackers were able to expertly breach these companies and extract the sensitive information. This study will investigate the vulnerabilities that were attacked in this intrusion and see if it could have been prevented or lessened. From reviewing technical reports, professional journals, and government notices, we intend to ascertain systemic loopholes that permitted this intrusion. Our approach will be to research organizational reports, credible news articles, and publicly available government documents that provide details on the method of attack and defensive vulnerabilities. Through this research, we aim to foreground actionable security measures that can strengthen critical telecommunication infrastructure resilience. We intend to elaborate on expected policy changes, security patching strategies, and risk management paradigms to prevent future such incidents. The aim is to provide actionable recommendations to telecom service providers, government agencies, and cybersecurity professionals to address threats of state-sponsored cyber attacks. By studying the tactics used in this intrusion, we can enhance cybersecurity protocols and protect key communication networks from future breaches.

Conner Skoumal, Jack Urbanczyk, Moe Elshareif, Hajira Sultona

Dr. Matt Plass

61A Walt Disney's Innovation in Audio Animatronics and Mechanical Figures

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Disney animatronics, a cornerstone of the company's theme park attractions, have been a symbol of technological innovation and artistic creativity since their inception. Disney Imagineering, the creative and engineering arm of The Walt Disney Company, has played a pivotal role in transforming the entertainment industry through the development of animatronics, blending cutting-edge engineering with storytelling. The evolution of animatronic technology began in the mid-20th century with the creation of mechanical figures for Disneyland's The Enchanted Tiki Room and Pirates of the Caribbean attractions, where engineers first implemented synchronized movement and lifelike behavior through hydraulic and pneumatic systems.

Over the years, advancements in robotics, computer programming, and artificial intelligence have significantly enhanced the realism of Disney animatronics. Early static models evolved into highly interactive, dynamic figures capable of precise, fluid motions, with lifelike facial expressions and voice synchronization. The integration of advanced sensors, motors, and artificial intelligence has enabled animatronics to respond to guest interactions, creating a more immersive experience.

Brandon Kemp, Justin Kemp

Dr. Gina Martinez

64A The Suez Canal and Nasser: Symbols of the Rise of Arab Nationalism and the Resistance of Western Imperialism

Undergraduate Student Project in Humanities & Communication

This research project explores the Suez Canal and former Egyptian leader, Gamal Abdel Nasser, as symbols of Arab nationalism and resistance to Western imperialism in the 20th century. The man-made maritime passage has long been an area of geopolitical tension between Egypt, Britain, and France. This project examines the history of the canal and the escalation of tensions that led to the Suez Crisis of 1956. The major focus of this research is Nasser's decision to nationalize the canal, which retaliated against Western influence and further fueled the rise of Arab nationalism throughout the Middle East. Nasser's measures and rhetoric were key to promoting unity among Arab nations and pan-Arabism as a unifying ideology against colonial rule.

This research uses primary and secondary sources to examine the historical context behind this event. Newspapers, personal memoirs, and public speeches offer first-hand accounts of the tensions during this period. Secondary sources, however, help to paint a broader picture of what happened and how this became one of the most important geopolitical issues of the 20th century.

This project concludes that the Suez Canal and Nasser himself became symbols of resisting Western influence in the Middle East as well as the subsequent rise of Arab nationalism and pan-Arabism as Middle Eastern countries sought to assert their independence.

Lindsey Minas

Dr. James Tallon

67A Analyzing the Influence of Megasonic Parameters on the Effectiveness of Chemical Additives in the Optimization of Post-Chemical Mechanical Planarization Cleaning Processes for Silicon Carbide Substrates

Graduate Student Project in Natural Sciences

As an emerging material for semiconductor manufacturing, silicon carbide (SiC) offers several advantages over traditional silicon, including a higher electric field breakdown and increased wear resistance. However, this produces a chemically inert surface that necessitates aggressive chemistries for chemical mechanical planarization (CMP) processes to achieve an atomically flat surface. Consequently, the post-polished substrate contains primary defects, such as nanoparticle residue, that must be eliminated. The conventional post-CMP cleaning method employs a polyvinyl alcohol (PVA) brush to mechanically remove primary defects while the cleaning chemistry serves both as lubrication for the brush/substrate interface and to transport residue away from the surface. Nevertheless, the brush can introduce secondary defects, such as scratching and pitting, and lead to particle redistribution due to the adsorption of nanoparticles onto the brush matrix. An alternative, low-stress approach for removing primary defects with minimal secondary defect generation is megasonic cleaning, which utilizes wave-induced cavitations within the cleaning chemistry. These cavitations supply the energy to generate hydroxyl radicals capable of chemically cleaving defect-substrate bond without mechanical stress. While prior studies have demonstrated the megasonic system's efficacy with various cleaning additives, those systems operated at a single frequency of wave generation within a static environment, which may not be optimal for facilitating surface-cavitations interactions. This study explores several other systems where megasonic energy can be utilized to activate cleaning chemistry and engage with the substrate. For the dynamic system, initial results demonstrate an increased particle removal efficiency (PRE) by increasing the range of interaction between substrate and megasonic transducer.

Piper Smith

Dr. Jason Keleher

70A Characterization and Synthesis of Cu-TiO2 Nanoparticles via Photochemical Methods for Enhanced Antimicrobial Efficacy

Graduate Student Project in Natural Sciences

With antibiotic-resistant microbes on the rise, the need for alternative antimicrobial materials has grown exponentially. Nanoparticles have been increasingly utilized for these materials due to their small size and large surface area, which allows for surface modification. Specifically, the use of semiconductor nanoparticles for the reduction of metal ions has been explored; however, more work is required to make the reduction of ions like Cu2 more efficient. This study focuses on the mechanism and efficacy of incorporating Cu2 into organo-metallic complexes for the photoreduction of Cu2 on the surface of TiO2. The use of amino acids such as glycine (GLY), serine (SER), and arginine (ARG) as ligands will be discussed. Additionally, the antimicrobial efficiency of the nanoparticles was investigated. Kirby-Bauer disk diffusion was utilized to determine whether the nanoparticles leach metal ions, indicated by the presence of a zone of inhibition. The lack of a zone suggested that the mechanism of cell death was not diffusive; however, the absence of bacterial growth underneath the disk indicated cell death. An epi-fluorescent optical tweezer was employed to explore alternative mechanisms. The optical tweezer was used to trap and hold a single bacterial cell within a highly focused IR laser beam and dock the cell to a nanoparticle film. The intensity of stained *E. coli* cells was tracked over time to probe the surface-contact mechanism of cell death at the bacterial-nanoparticle film interface. Results have shown that Cu-TiO2 exhibits an increased rate of bacterial cell death within five minutes of exposure.

Samuel Robles

Contributors: Katey M. Sheets, Connor J. Keating, Jadyn C. Dominguez

Dr. Jason Keleher

73A Edaravone 4-trifluoromethyl Analyses of its Radical Scavenging Ability

Undergraduate Student Project in Natural Sciences

Edaravone has been proven to be a useful therapeutic in alleviating the symptoms of ALS and other oxidative stress disorders. It is known that radicals cause significant damage to the body, including ischemic damage to the brain. Considering there is evidence of both edaravone and 4-trifluoromethyl as having antioxidant properties, it is hypothesized that the addition of an electron withdrawing group can lead to more effective radical scavenging in the body. To determine the effectiveness of this compound's radical scavenging activity and copper chelation abilities, the indicator radical, DPPH, is used to measure the rate of scavenging activity. If the edaravone 4-trifluoromethyl is effective, the DPPH will register as yellow in color, indicating that the radical is stabilized. If the DPPH registers as purple, the radical has not been ameliorated and the edaravone 4-trifluoromethyl would be considered an ineffective therapeutic. Results will be discussed.

Sara Ryan, Quinn Stevens, Maggie Platek

Dr. Kari Stone

76A Electrochemical Cell Optimization for Polymer-MOF Composite Electrodes as Supercapacitors

Undergraduate Student Project in Natural Sciences

Brother Bernard Rapp Research Fellowship and Research Focus Award

Supercapacitors have emerged as a bridge between battery materials and solid-state capacitors. Supercapacitors, also known as electrochemical capacitors, store energy by mobilizing charges on the electrochemical double layer or through faradaic interactions at the electrode-electrolyte interface. However, the rate of diffusion for ions in solution and faradaic materials to the electrode is dependent on charge mobility and porosity of the electrode materials, making cyclic voltammetry insufficient for frequency-dependent analysis. Cyclic voltammetry (CV) uses a time-dependent domain that has a far greater range to have an effective analysis of diffusion rates. Using electrochemical impedance spectroscopy (EIS), which uses a frequency-dependent domain, allows for in-depth analysis at specific ranges to determine the diffusion rate of the system. Kissel research Lab has recently explored a novel synthetic approach to engineering metal-organic framework (MOF) polymer composites. However, cell optimization remains a key point in maximizing the efficiency of these composites as supercapacitor materials. Cell optimization relies on precise frequency and time-dependent measurement of diffusion rates onto the electrochemical double layer to maximize supercapacitor efficiency. Metal-organic framework composites comprised of UiO-66-NH2, MiL-125-NH2, MiL-125-NH2@ ZIF-67, and MiL-100-Fe were examined in this study. The cell conditions for these materials were evaluated and optimized using cyclic voltammetry and electrochemical impedance spectroscopy. Mass transport was investigated using electrochemical impedance spectroscopy.

Adam Makhlouf, Nathan Hajek

Contributor: Adan Martinez

Dr. Daniel Kissel

79A Establishing the Optimal Parameters for Minimizing the Static Etch Rate for Advanced p-CMP Cleaning Applications

Graduate Student Project in Natural Sciences

As technology continues to advance, there is a constant pressure on microchip manufacturing to increase the quantity of transistors while decreasing overall chip size. This is crucial to ensuring the enhancement of processing speeds while maintaining a small device size. Due to this pressure there are constant innovation efforts to improve the efficiency of flattening the surface topography of common microchip substrates. A key method to address this issue is Chemical Mechanical Planarization (CMP), which uses a combination of abrasive slurries, cleaning chemistry, and various PVA brushes and polyurethane pads to achieve a defect free smooth substrate surface. While CMP is an effective flattening method, it also introduces a plethora of possible surface defects in the substrate. These defects include scratching, etching, and corrosion. An integral step to help combat these CMP defects is through post-CMP cleaning of the various substrates. One of the major emerging substrates of interest in the CMP process is copper which is highly conductive, but highly susceptible to corrosion. The focus of this project is to determine the optimal conditions to reduce the corrosion-based static etch rate of copper-plated silicon dioxide wafers when subjected to proprietary cleaning chemistry solutions. Various conditions were tested, including the length of solution exposure, wafer rotation, and the dissolved oxygen concentration of the cleaning chemistry. Initial data shows that as temperature increases by a factor of 10?C the static etch rate increases by 2 Å/min in an oxygen rich environment and decreases as the length of exposure increases.

Nicole Staszak

Dr. Jason Keleher

82A Machine-Learned ROM for Radiation Source Simulation

Graduate Student Project in Engineering, Computer Science, and Mathematics

STEM research initiation award

Large-scale Monte Carlo simulations, while crucial for modeling radiation transport, face challenges in practicality and computational resource requirements. To address this, we previously developed a reduced order modeling (ROM) approach to capture the dynamics of specific transport applications, further reducing the computational requirements for accurate results. Our earlier work focused on the application of characterizing radiation spectra measured from weak radiation sources emitting only a small number of particles. In this study, we extend our ROM framework to investigate the effects of shielding and material impact on radiation sources emitting with limited particle emissions.

We propose an efficient Machine-learned reduced order model integrates proper orthogonal decomposition (POD) and neural networks. POD is adapted for use with Monte Carlo simulations to extract basis functions for the reduced order model and then the neural network is used to further refine the basis functions to improve the accuracy in the model. This approach enables a more precise and efficient representation of radiation transport phenomena. The effectiveness of our method is demonstrated through a terrestrial radiation detection scenario, highlighting its potential for real-world applications in radiation shielding and source characterization.

Ajay Gopavarapu, Eswar Reddy Tippireddy

Dr. Indika Udagedara

85A Influence of Megasonic Power on the Non-Contact Removal Efficiency of CeO^2 Nanoparticles for Emerging Shallow Trench Isolation (STI) Post-CMP Cleaning Processes

Graduate Student Project in Natural Sciences

Tetraethyl Orthosilicate (TEOS) is often used in Shallow Trench Isolation (STI) because of its dielectric properties. STI is a technique used in the semiconductor industry to isolate transistors in integrated circuits. CMP (Chemical Mechanical Planarization) is necessary for smooth and flat surfaces of the dielectric material preventing defects and reduced yield in device manufacturing. Ceria (CeO2) nanoparticle slurries are used in STI as they attach to the surface and have high selectivity to silicon. The Ceria (CeO2) attaches to the TEOS surface creating a bond Ce-O-Si. After the CMP process, there are still nanoparticles on the substrate that need to be removed to improve the dielectric material's efficiency. An effective p-CMP technique is physical cleaning using polyvinyl alcohol (PVA) brush scrubbing (a contact process). Even though it's efficient, the brush contact mechanism will make defects on the surface. To reduce the damage on the surface, megasonic waves (a non-contact process) could be employed to clean the substrate's nanoparticles scratches. Megasonic energy creates high-frequency waves into the cleaning chemistry creating cavitation leading to the break the bond Ce-O-Si. This study focuses on characterizing the best energy-induced parameters to the process of STI post-CMP using high frequency waves. It explains the surface cleaning mechanism of the dielectric material (TEOS. The variation of particle removal efficiency (PRE) as a function of the wattage induced into high-frequency waves in water will be discussed. Initial data shows an increasing trend in the PRE as megasonic power increases.

César Alvarado Orellana

Dr. Jason Keleher

88A Inhibition of Metallo-Beta-Lactamases in Gram-Negative Bacteria

Graduate Student Project in Natural Sciences

The rise of antibiotic-resistant bacteria poses a significant threat to public health, complicating treatment options and increasing mortality rates. These enzymes require metal ions (e.g. Zn2 cofactors) for their activity and have emerged in multiple bacterial species, leading to resistance against a broad spectrum of beta-lactam antibiotics, including carbapenems. New Delhi Metallo-beta-lactamase (NDM-1) is a bacterial enzyme that hydrolyzes the beta-lactam ring in beta-lactam antibiotics, rendering them inert. This experiment studies NDM-1 mutants, M154L and D97N, produced through site-directed mutagenesis and transformed in *Escherichia coli* cells. The efficacy of NDM-1 inhibitors was assessed through a hydrolysis assay. Understanding the structure, function, and inhibition of MBLs is essential for developing new approaches to address this global challenge. Results of this study will be discussed.

Genesis Dennis, Ezra Samson

Dr. Kari Stone

91A Neutronics Simulations for Energy Extraction of a Direct Fusion, Dr.ve

Graduate Student Project in Natural Sciences

Direct Fusion, Dr.ves (DFDs) hold potential for deep space missions by thrusting charged particles produced during fusion processes through an exhaust port via magnetic fields. Neutrons are also produced through fusion and carry significant kinetic energy. Neutral particles are unaffected by magnetic fields and can deposit energy into materials surrounding a DFD reactor core, which can be harnessed to generate power for the spacecraft. A DFD engine operating on deuterium-helium-3 (D-3He) fusion was simulated using the computing platform Geant4. Cylindrical geometries of varying materials and thicknesses were optimized for energy transfer to coolant materials while minimizing spacecraft mass and energy losses to the environment.

Tom Harless

Dr. Ryan Hooper

94A Physiochemical Interactions between Reductive Small Molecule Surfactants and CeO2 Nanoparticles in Sono-Activated post-CMP Cleaning

Graduate Student Project in Natural Sciences

Chemical Mechanical Planarization (CMP) is a critical step in the fabrication of semiconductor devices to achieve nanoscale surface planarity. Shallow Trench Isolation (STI) CMP, which defines active regions of dielectric layers in integrated circuits, involves polishing tetraethyl orthosilicate (TEOS) and silicon nitride (Si3N4) films using ceria-based slurries. However, residual ceria (CeO2) nanoparticles must be effectively removed after CMP to prevent defects and yield loss; conventional brush-based cleaning methods can result in inadequate particle removal, surface scratching, and electrostatic adhesion, making alternative cleaning approaches necessary. This study examines the synergistic effect of amino alcohol chemistries and megasonic energy for improved CeO2 particle removal in STI post-CMP cleaning. Amino alcohols exhibit dual-functional ability to enhance nanoparticle surface redox behavior and interact with oxide interfaces. Preliminary investigation of their adsorption behavior and electrochemical properties reveal increased charge transfer

kinetics of CeO2 nanoparticles, correlated with improved cleaning efficiency of TEOS surfaces. Cleaning performance was assessed through particle removal efficiency (PRE) as a function of amino alcohol concentration, complemented by quartz crystal microbalance (QCM) and dynamic electrochemical studies to further understand adsorption and redox-driven interactions with ceria nanoparticles. Additionally, megasonic cleaning parameters—including power, frequency, and system design (flow-through vs. immersion vessel)—were optimized to enhance removal efficiency while minimizing surface roughness.

Elizabeth McDonnell, Sydney Tremblay

Dr. Jason Keleher

97A Polymer/MOF Hybrid Composite Beads for Photocatalytic Remediation of Organic Dye Pollutants

Undergraduate Student Project in Natural Sciences

Summer Undergraduate Research Experience (SURE)

Metal Organic frameworks (MOF) are porous inorganic structures that have recently been explored for different applications in catalysis, including photocatalysis. The Ti(IV) MOF MIL-125-NH 2 is particularly interesting because of its unique photoactivity and porosity. Unfortunately, many MOFs suffer from stability issues in solution, which limits their application to non-solution-based systems. To combat these stability issues, MOFs can be incorporated into polymer matrices to create polymer-MOF hybrid composite materials. This work reports on a novel cellulose-MIL-125-NH 2 composite material that was used for photocatalytic remediation of organic dye pollutants. Cellulose, which is the world's most abundant natural polymer, was used to encapsulate the MOF into spherical beads. These cellulose-MIL-125-NH 2 beads were investigated for their ability to photocatalyze the degradation of methylene blue in the presence of light using spectrophotochemical analysis. The cellulose-MIL-125-NH 2 beads show a remarkable ability to capture and degrade methylene blue from solution.

Nolan Hooper

Dr. Daniel Kissel

100A Slurry Activation Via Megasonic Energy for "Low Stress" CMP Processes for Emerging Defect Free STI Processes

Graduate Student Project in Natural Sciences

Chemical Mechanical Planarization (CMP) is a vital process in semiconductor manufacturing that enables precise planarization for advanced device fabrication. One important application is shallow trench isolation (STI), where CMP eliminates excess dielectric material to create electrical isolation between transistors while ensuring surface uniformity. Ceria-based slurries are frequently used in STI CMP due to their high selectivity for oxide removal and their chemical reactivity, which facilitates efficient tetraethyl orthosilicate (TEOS) polishing with minimal defect formation. However, optimizing slurry performance presents a significant challenge in improving material removal rates (MRR) and surface quality. Recent advancements have explored the use of acoustic megasonic energy to enhance ceria slurry reactivity. Megasonic-induced cavitation events cause localized high-energy collapses, releasing mechanical and thermal energy into the slurry. This energy interacts with slurry chemistry to produce reactive oxygen species (ROS) such as singlet oxygen and superoxide anions, which promote ceria redox cycling by aiding the reduction of Ce4 to Ce3. The increased presence of Ce3 boosts the oxidative capacity of the slurry, leading to improved MRR. The effectiveness of this enhancement is closely linked to the frequency-dependent behavior of cavitation, as different frequencies influence bubble collapse intensity, ROS generation, and slurry reactivity. This work examines the connection between megasonic energy frequency and ceria slurry chemistry to optimize TEOS polishing in STI CMP.

Connor Keating

Contributor: Elizabeth McDonnell

Dr. Jason Keleher

103A Study of NO2 Emission from Remote Sensing with Spacial Mapping

Graduate Student Project in Natural Sciences

Faculty Development Research in the Scholarship of Teaching and Learning

Nitrogen dioxide and particulate matter (PM 2.5) are air pollutants with significant implications for public health and environmental quality. This study focuses on the Joliet, Illinois and the canal area, a region of interest due to its extensive industrial activity and the presence of large warehouse complexes that generate a substantial amount of diesel truck traffic. Diesel truck emissions are a major source of nitrogen dioxide and particulate matter, which contribute to localized air quality challenges and potential health risks for those in nearby communities. Using data obtained from NASA's Earthdata portal, this research employs geospatial analysis and visualization techniques in Python hosted through Google Colab to map and analyze the distribution of nitrogen dioxide and PM 2.5. The study highlights the impact of transportation emissions, particularly from diesel semi-trucks, on air quality in this major supply chain corridor and identifies nitrogen dioxide pollution hotspots within the region. Spatial analysis suggests that nitrogen dioxide concentrations are strongly associated with areas of high truck traffic and heavy industry and impacts air quality in and around Environmental Justice (EJ) communities in the area.

Tyler Ranieri

Dr. Joeseph Kozminski

106A Understanding the Interfacial Dynamics of a Two-Layer Responsive Hydrogel System for Wound Healing Applications

Graduate Student Project in Natural Sciences

The current management of chronic wounds includes debridement, antibiotic treatments, and coverage; however, constant monitoring is necessary. This increases the risk of causing further damage to the wound bed or delaying healing. Hydrogels have become increasingly appealing as alternative wound healing materials due to their intrinsic properties, such as the integration of additives, tunable tensile strength, and swelling capacity, which make them ideal candidates. This work focuses on designing and characterizing a two-layer responsive nanocomposite system. The first layer (i.e., the wound healing layer) consists of an alginate network that is non-covalently crosslinked with calcium and infused with antimicrobial nanoparticles and amino acids known to aid in wound healing (e.g., glycine, serine, and arginine). The antimicrobial nanoparticles infused into the network were evaluated using an epi-fluorescent optical tweezer to trap and dock a single bacterial cell to the surface and monitor the fluorescent signal over time. Kinetic results indicate an increase in the rate of bacterial cell death within 5 minutes of exposure. The second layer (i.e., the responsive layer) consists of a covalently crosslinked network of cellulose coupled with the secondary functionalization of polyaniline (PANI). Current-voltage sweeps were conducted to confirm the polymerization of PANI throughout the network, demonstrating increased charge transfer capacity. The bi-layer nanocomposite has shown enhanced charge transfer capacity as a function of swelling; specifically, upon saturation with simulated wound exudate, there is an increase in charge transfer through the polymeric network to illuminate an LED.

Katey Sheets

Contributors: Jadyn C. Dominguez, Connor J. Keating

Dr. Jason Keleher

109A Whole-cell Catalysis for the Degradation of Azo Dye

Undergraduate Student Project in Natural Sciences

Summer Undergraduate Research Experience (SURE)

Azo dye effluents from textile manufacturing have become a significant environmental concern due to their carcinogenic and toxic breakdown products. *Caldariomyces fumago* secretes the heme enzyme, chloroperoxidase, which effectively catalyzes the oxidation and subsequent degradation of azo bonds, facilitating the breakdown of azo dyes. Encapsulation of *C. fumago* in calcium alginate beads enhances its stability and viability, making it well-suited for continuous flow systems and biosensors. The encapsulation can be achieved using either spores or mycelium, both of which support rapid fungal growth and robust chloroperoxidase secretion into the alginate matrix. Encapsulation of the microorganism offers a promising, sustainable, and efficient

strategy for the bioremediation of hazardous compounds in wastewater. This approach optimizes enzyme activity and maximizes the catalytic potential of the system. The findings from this study highlight the efficacy of using whole-cell catalysis and alginate bead encapsulation to develop a scalable and environmentally friendly solution for azo dye remediation.

Audrey Ang

Dr. Kari Stone

112A RSA/Lockheed Attack

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

In 2011, the major defense contractor for the U.S. Lockheed Martin was the target of a cyberattack. The cyberattack exploited RSA SecurID tokens, which is a single-use key used for two-factor authentication. The exploit came as a result of a previous hack on RSA itself, where attackers were able to extract all the SecurID tokens. This allowed the attackers to authenticate into the Lockheed Martin network as legitimate users. In the event of the attack, Lockheed Martin took steps to increase IT security and lower the reliance on SecurID. Under this attack, the U.S. government felt that certain cyberattacks on government organizations could constitute an act of war. After the incident unfolded it was shown that It was not one lone hacker attacking the defense corporation but rather a state-sponsored group. Looking at the present, Lockheed has witnessed many data breaches such as this one and the enforcement of MFA (multi-factor authentication) has been the most effective in combatting cybercrimes. This system denies unauthorized access, even if certain information such as ID credentials is stolen. The occurrence that happened to Lockheed Martin marked the vulnerabilities of the cybersecurity framework and in certain parts of the defense sector. This paper will analyze and describe in detail the attack, from both the beginning and the end, as well as the parties involved. Additional details will include mitigations and lessons that can be learned from this incident. This can also lead to an example where certain organizations can update their security and use it to eliminate any threats leading to cybercrime.

Allysa Visperas, John Siek, Kacper Zalewski, Iong Nguyen

Dr. Matt Plass

115A Tennis Practice Robot

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Practicing tennis alone is often repetitive and limited to self-tossing or wall rebounds. The Tennis Practice Robot enhances solo training via either autonomously or user input positioning and launching balls at adjustable speeds, angles, and locations, creating a more dynamic and realistic practice experience. At its core, the robot is controlled by an Arduino Uno, housed within a wood and plastic chassis with omnidirectional wheels, powered by DC motors and a rechargeable battery pack. The ball-launching system features high-RPM DC motors and a gated ball feeder for controlled delivery. For precise navigation and obstacle avoidance, the robot integrates ultrasonic sensors, an inertial measurement unit (IMU), and motor encoders. A wireless remote allows users to customize ball speed, placement, and randomization settings. Additionally, a built-in display provides real-time system feedback, while an emergency stop function ensures safety. A modular testing approach is employed, validating each subsystem before full integration. Final evaluations focus on mobility accuracy, launch precision, connectivity reliability, power efficiency, and overall safety. With an estimated cost below $1,000, this project aims to deliver an affordable, intelligent, and customizable tennis training solution that surpasses existing alternatives.

Julian Pala, Joseph Jesse

Dr. Gina Martinez

POSTER SESSION B

THURSDAY • APRIL 24

2:15–3:15PM

FIELDHOUSE

2B Aviation Maintenance Learning Processes

Undergraduate Student Project in Aviation

FAA requires students who wish to be A&P's to go through an AMT or similar experience to learn skills needed to work on aircraft. For an AMT it is important to teach electricity troubleshooting as it is a skill that will be heavily used in the industry. I am Michael Dachniwsky and I work as a Teacher's Assistant and an A&P technician's apprentice in the Aviation Industry. This project was developed using real world skills that I have developed to create a lab that not only trains AMT students on how to diagnose issues on a real world aircraft but how to fix it in FAA approved methods. This project effectively brings real world experiences to the classroom allowing them to learn these skills before entering the industry. The focus is on Electricity 2 hands-on lab environment. The project created a project for students to complete that included diagnosing an issue with an aircraft wing and rewiring the necessary components to return the aircraft to service. It involves students in the AMVT 2200 Electricity 2 Spring 2025 class. This task includes a series of skills necessary for working in the industry such as reading electrical schematics, determining the fault, and then fixing the fault by "replacing" wires, and then writing a logbook entry. The log book entry includes a diagnosis of the issues found, the corrective actions accomplished and the references that the students used to accomplish the task. Data collected is time working on the project.

Michael Dachniwsky

Dr. Brian Kozak

5B Exploratory Analysis of Trends in Aviation Safety Action Program (ASAP) Reports at Lewis University

Graduate Student Project in Aviation

This study aims to explore trends and patterns in Aviation Safety Action Program (ASAP) reports at Lewis University over the past year. Specifically, it examines how the frequency of non-serious reporting has evolved and identifies general changes in reporting types and characteristics over time. Additionally, the study seeks to gain insights from these reports in the context of recent safety initiatives, including weekly safety updates.

The hypothesis proposes that trends in ASAP reports reflect changes in reporting frequency and behavior, potentially influenced by recent operational initiatives. The alternative hypothesis suggests that external factors, unrelated to operational initiatives, may be influencing variations in reporting, while the null hypothesis posits that no significant relationship exists between recent changes and the frequency or nature of incidents reported.

An exploratory, mixed-method approach is used, focusing primarily on quantitative analysis while incorporating qualitative insights for additional context. Data is drawn from approximately 186 ASAP reports and weekly safety updates. The quantitative analysis includes descriptive statistics, trend and pattern visualization, and frequency distribution to identify notable patterns. Qualitative analysis involves re-coding of ASAP reports by collaborators to provide context for observed trends.

Brian Van Acker, Nolan Quinn, Jacob Kopczyk, Luke Halverson

Dr. Erik Baker

8B Fatigue Culture External

Graduate Student Project in Aviation

Fatigue significantly impacts aviation safety, with its reporting influenced by diverse cultural norms and perceptions. This study compares survey data from pilots of varied cultural backgrounds, focusing on 10 questions with notable contrasts. The analysis explores differences in familiarity with fatigue policies, reporting barriers, and management systems' trust. Results reveal cultural and systemic factors that shape reporting behaviors, offering insights for enhancing global fatigue management practices. Recommendations are tailored to address cultural sensitivities, foster transparency, and improve training efficacy.

Leanne Peter, Rebecca Cravedi, Xinghua Wang, Karthik Varatharaj

Dr. Erik Baker

11B Flight Data Monitoring at LU Flight School

Graduate Student Project in Aviation

This study analyzes abnormal flight events in the Cessna 172s fleet at Lewis University using data from the National General Aviation Flight Information Database (NGAFID) from September 2023 to August 2024. The research compares maintenance-related events (e.g., EGT Sensor Divergence, Cylinder Head Temperature anomalies, CHT Sensor Divergence) and operational-related events (e.g., High Altitude Stall, Low Airspeed on Approach, Roll) between the Cessna 172S fleet and other NGAFID fleets. The primary hypothesis shows that maintenance-related events are more frequent in the Cessna 172S fleet, while operational events are less frequent compared to other fleet. The study explores factors such as engine performance and maintenance schedules that may contribute to these differences while also investigating the role of pilot training and operational procedures in reducing operational-related events. Data will be analyzed using descriptive statistics and NGAFID to determine whether significant differences exist between the Cessna 1725 fleet and other fleets. Findings from this study may offer insights into optimizing aircraft maintenance procedures and improving pilot performance to enhance overall flight safety.

Tevon Fernando, Nagavinay Oja, Won-joon Jung, Rajesh Kadire

Dr. Erik Baker

14B Flight Student Fatigue at Lewis University

Graduate Student Project in Aviation

Fatigue is a critical part of the aviation industry, and before any flight, pilots need to be aware of the impacts that this has on the safety of their flight. As a training institution, there needs to be ample discussion between Certified Flight Instructors and students to ensure safety is always a top priority. The research attempted to define what factors contribute to pilots flying while fatigued, and receive an in-depth view into the culture regarding fatigue at Lewis.

Claybert Pusung, Wiktoria Maslak-Schiwnak, Caswell Bloomquist

Dr. Erik Baker

17B Redesign and Testing of a Wireless Power Transfer Apparatus

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

Wireless Power Transfer (WPT), first discovered by Nikola Tesla, has many modern applications ranging from charging portable devices to vehicles. In standard wireless charging coil configurations, the transmitter coil produces a pulsed current, commonly known as an alternating current, that induces a current in a receiver coil that is completely separate from the transmitter circuit. The changing current produces a changing magnetic field that creates a current in the receiver coil, providing the power to visually light an LED bulb or flow through an attached resistor. In our system, the transmitter coil consists of bifilar speaker wire and is connected to a simple transistor circuit, which makes the apparatus cost efficient. Even though the circuit is supplied with a direct current, the transistor produces a pulsed current that the single stranded receiver coil detects to mimic alternating current. This research focuses on the effects of vertical displacement between the coils, as well as the effects of different parameters applied to each set of coils. To minimize uncertainty within our collected data, we have repurposed and adapted a 3D printing system to utilize the controlled ascent and descent across the vertical axis. Pieces that were magnetic that affected the induced magnetic field were

removed and replaced with non-magnetic, 3D printed items. Data were collected again using coils with varying parameters (number of turns, radius, wire gauge, etc.) showing more repeatable and reliable results.

Emily Lindemann, Alex Forster

Dr. Joseph Kozminski

20B Strategic Coloring: A Game-Theoretic Approach to Graph Coloring

Undergraduate Student Project in Engineering, Computer Science, and Mathematics

This research constructs a two-player graph coloring game by applying concepts from graph theory and combinatorial games. A graph consists of vertices connected by edges, and a total coloring assigns colors to both while ensuring that no two adjacent elements of the graph share the same color. The minimum number of colors needed for a valid total coloring is called the total chromatic number of the graph. In our game, two players take turns coloring either a vertex or an edge of a given graph from a predetermined set of colors, following total coloring rules. Player A moves first, and the players take turns until the game ends—Player A wins if the entire graph is successfully colored, while Player B wins if any element cannot be legally colored. We define the game as the minimum number of colors required to guarantee a win for Player A, assuming both players play optimally. This research aims to determine for different families of graphs by identifying strategies where each player can force a win. By analyzing these strategies, we uncover patterns in optimal play and explore how different graph structures affect the outcome of the game.

Zachary Campbell, Mackenzie Welsh

Dr. Marie Meyer

23B Investigations of Metallo-Beta-Lactamases to Combat Antibiotic Resistance

Undergraduate Student Project in Natural Sciences

Doherty Center for Aviation and Health Research

Antibiotic resistance remains a critical global health threat, with resistant pathogens evolving through human, animal, and environmental interactions. A key challenge in this area is the rise of metallo-beta-lactamases (MBLs), such as NDM and VIM, which degrade commonly used antibiotics, rendering them ineffective. However, ongoing research has highlighted the potential of 8-hydroxyquinolines (8HQs) as a scaffold for drug discovery, particularly due to their zinc-sequestering properties. These properties may inhibit MBL enzymatic activity, presenting a promising strategy to combat resistance. Additionally, techniques like virtual screening and molecular docking offer efficient means to identify potential inhibitors, providing valuable insights into their binding interactions with target enzymes. This approach not only helps identify effective inhibitors against VIM and NDM-resistant strains but also supports the development of compounds that disrupt MBL catalytic activity. By focusing on the zinc-binding ability of MBLs and leveraging the 8HQ scaffold, this research aims to restore the efficacy of beta-lactam antibiotics. If successful, these efforts could provide a significant advancement in addressing MBL-mediated antibiotic resistance.

Rihan Alwan

Contributor: Anthony Baudino

Dr. Kari Stone

26B A233V Mutant NDM-1 Enzyme for Metallo-Beta-Lactamase Inhibition Study

Undergraduate Student Project in Natural Sciences

The ability of bacteria to resist antibiotic treatment can be due to a variety of features, for example, the presence of enzymes that render the antibiotics ineffective. One such enzyme of particular concern are metallo-beta-lactamases. These enzymes catalyze the hydrolysis of beta-lactam antibiotics, a class of antibiotics that specifically target the synthesis of bacterial cell walls to induce cell lysis. The A233V mutant of NDM-1 metallo-beta-lactamase is designed, inserted into a vector and expressed using *E. coli* cells. Protein function after mutation is studied through characterization and assays, in order to observe the effects of the mutation on protein function to identify crucial amino acid residues important for activity and stability. Inhibitors will be tested on mutant proteins to evaluate their effectiveness and to further understanding of inhibitor mechanisms. Results will be discussed.

Kate Green

Dr. Kari Stone

29B An Examination of the Influence of Megasonic Cleaning Techniques on the Surface Damage and Particle Removal Efficiency of Emerging Substrates

Undergraduate Student Project in Natural Sciences

Chemical Mechanical Planarization (CMP) has become a critical processing step in semiconductor manufacturing for achieving atomically flat surfaces of silicon carbide (SiC). To achieve this, the planarization process uses nanoparticles and a downward shear force in the presence of chemistry that can create the dynamic interfacial reaction required for performance. Once the planarization and polishing process of these wafers is completed, the next step is to eliminate the particles remaining on the wafer's surface as a primary defect. This step is known as post-CMP (p-CMP) cleaning and if these particles are not adequately removed, they can result in device failure. The standard cleaning process employs a polyvinyl alcohol (PVA) brush that makes contact with the wafer's surface to remove the residual particles. However, this cleaning method can also cause secondary surface defects due to the abrasive properties of the particles that might attach to the brush during cleaning (i.e., brush loading). To mitigate this issue, an alternative non-contact cleaning method utilizing megasonic waves has been proposed. By using megasonic waves, there is a decrease in surface roughness since there is no direct contact with the wafer. Additionally, modifying the cleaning chemistry can change the efficiency of the particle removal (i.e., PRE). Initial results show that megasonic cleaning at a high frequency produces a PRE that is on par with results produced from direct-contact cleaning but results in fewer surface defects.

Arielle DeShazier

Contributor: Piper Smith

Dr. Jason Keleher

32B Analysis of Edaravone as a Free Radical Scavenge

Undergraduate Student Project in Natural Sciences

Edaravone has been used to treat ALS in multiple case studies. Because ALS is a severe neurodegenerative disease linked to oxidative damage and abnormal copper levels, it is hypothesized that edaravone has the ability to chelate copper and scavenge free radicals. Antioxidants such as glutathione are also known to be effective radical scavengers. To determine the effectiveness of edaravone as a free radical scavenger, edaravone will be studied and in a parallel experiment using glutathione comparing the rate of free radical scavenging. Results will be discussed.

Victoria Gronski, Elizabeth Hajnos, Emma Bertotto, Reese Capion

Contributor: Adan Martinez

Dr. Kari Stone

35B Analysis of Edaravone-3-methyl as Therapeutic Treatment for ALS

Undergraduate Student Project in Natural Sciences

Amyotrophic lateral sclerosis (ALS) is a neurodegenerative disease that causes the complete degradation of brain and spinal cord nerve cells in over 200,000 people worldwide. Edaravone has been compared to ascorbic acid, another free radical scavenger. Because studies have shown that the drug edaravone has been used to treat stroke and ALS, it is hypothesized that the addition of 3-methyl will amplify the elimination of free radicals and analyzed with the stable radical, DPPH, in addition to its copper chelating activity. These results will be compared to edaravone. Results will be discussed.

Adelena Sabanoski, Sarah Kmak, Caden Pearl, Meadow Terry

Dr. Kari Stone

38B Analyzing Tribochemical Interactions in Simulated p-CMP Cleaning Processes of Emerging Metals for Integrated Circuit Devices

Undergraduate Student Project in Natural Sciences

Chemical Mechanical Planarization (CMP) is a crucial step in producing defect-free planar surfaces through chemical reactions and mechanical forces at the wafer/slurry/pad interface. One challenge is that during CMP, the wafer can accumulate nanoparticles and organic residues that must be removed to achieve the required surface quality. To address

this issue, p-CMP cleaning is implemented, which is a method to eliminate residues using a polyvinyl alcohol (PVA) brush and cleaning chemistry in contact with the post-polished wafer. During the p-CMP cleaning process, there is a risk of oxidation of the substrate, which could lead to device malfunctions. To better understand this situation, an investigation into the tribochemical interactions at the three-body interface was conducted. The macroenvironment can be analyzed by varying several conditions—such as oxygen saturation, pressure/brush velocity effects, and cleaning chemistry—to identify the optimal interactions at the three-body interface. This work employs dynamic and static electrochemical analysis, performed on the three-body interface, resulting in a Tafel plot. Using the Butler-Volmer equation, Tafel analysis provided insights into how different conditions influenced the interactions at the three-body interface. Previous data indicated that a decrease in oxygen saturation within the cleaning solution, under various mechanical conditions, led to a significant reduction in the corrosion rate of the Mo substrate. For example, at higher displacement and rotational speeds, there is a decrease in the interfacial corrosion rate, which may be related to the modulation of the metal oxidation process and the more rapid removal of detrimental waste products from the surface.

Austin Rockaitis
Contributors: Nicole Staszak, Amanda Warfield, Elizabeth McDonnell

Dr. Jason Keleher

41B Assessment of the Stability and Reactivity of Reactive Oxygen Species in Chemical Mechanical Polishing (CMP) Processes

Undergraduate Student Project in Natural Sciences

As semiconductor technology advances, the demand for efficient chemical mechanical planarization (CMP) processes remains high. CMP relies on various mechanical and chemical actions to achieve a defect-free, smooth wafer surface. However, challenges emerge with increased downforce or pad speed, which can lead to surface defects or inadequate material removal rates. This study explores the presence of reactive oxygen species (ROS) generated through megasonic energy at the pad/wafer interface to enhance slurry efficiencies effectively. Megasonic energy, produced by low and high-frequency flow-through reactors, generates cavitation in the cleaning solution, resulting in a variety of ROS, including hydroxyl radicals and singlet oxygen. These ROS have been shown to improve the efficiency of slurries by modifying nanoparticle-surface interactions. The characterization of ROS was performed using oxidation-reduction potential (ORP) measurements and dissolved oxygen analysis. Radical trapping with p-nitrosodimethylaniline was conducted to quantify the ROS presence at different times and distances after generation. The findings demonstrate that megasonic energy activates chemistries to a more oxidative state through ROS generation, causing better removal rates and less wafer defects.

Sydney Tremblay

Dr. Jason Keleher

44B Characterization and Inhibition of the Double Mutant, V88L and M154L of NDM-1 Metallo-Beta-Lactamase

Undergraduate Student Project in Natural Sciences

The increasing ability of bacteria to resist antibiotics has become a significant concern in the field of medicine. In certain instances, bacterial antibiotic resistance can be attributed to the presence of specific enzymes. A particularly concerning class of enzymes are metallo-beta-lactamases, which catalyze the hydrolysis of beta-lactam antibiotics. These antibiotics target bacterial cell wall synthesis, ultimately inducing cell lysis. The double mutant, V88L and M154L of NDM-1 metallo-beta-lactamase is engineered and expressed using *E. coli* cells. The double mutation has been known to demonstrate more activity than the wildtype. Following the mutation, studies are conducted to evaluate the protein's function and to characterize the impact of the mutation on its activity. Inhibitors are subsequently tested on the mutant proteins to assess their efficacy and further deepen the understanding of inhibitor mechanisms. The results will be presented.

Cole Johnson

Dr. Kari Stone

47B Characterizing the G189D Mutation in Metallo-Beta-Lactamase: Implications for Antibiotic Resistance

Undergraduate Student Project in Natural Sciences

The increasing prevalence of antibiotic-resistant bacteria has become a significant public health concern due to the widespread overuse and misuse of antibiotics in both clinical and agricultural settings. One major mechanism of antibiotic resistance involves metallo-beta-lactamases (MBLs), a class of zinc-dependent enzymes that catalyze the hydrolysis of the beta-lactam ring found in many antibiotics, including penicillin, cephalosporins, and carbapenems. This hydrolysis renders the antibiotics ineffective, leading to treatment failures and limited therapeutic options for bacterial infections. In this study, the G189D mutation was introduced into the metallo-beta-lactamase enzyme to investigate its structural and functional impact, particularly in response to inhibition. Various inhibitors were tested against the mutated enzyme to assess their efficacy in suppressing its catalytic activity. Enzyme kinetics were evaluated through kinetic assays, measuring parameters such as reaction velocity, inhibition constants, and substrate affinity. The results provide insights into potential strategies for developing effective inhibitors to combat antibiotic resistance.

Audrey Ang

Dr. Kari Stone

50B Copper Chelation via Ascorbic Acid and Beta-alanine as a Therapeutic Approach in a *C. elegans* Model of Alzheimer's Disease

Undergraduate Student Project in Natural Sciences

Doherty Center for Aviation and Health Research

Throughout modern scientific history, efforts to understand Alzheimer's Disease (AD) have been based on a few tested principles. The leading hypothesis for the onset of the disease has traditionally focused on the aggregation of Amyloid-beta into amyloid plaques. However, many therapeutics targeting amyloid plaques have failed to deliver any sustainable results in clinical trials. Therefore, alternative methods must be investigated. Many AD patients have an imbalance of metal ions, such as copper and zinc, in addition to the aggregation of Amyloid-beta. The interaction between metal ions and Amyloid-beta can consequently produce reactive oxygen species (ROS). ROS can lead to oxidative stress on a cellular level, thus harming neurons and nearby tissues, ultimately provoking neurodegeneration. In our previous studies, copper chelation with beta-alanine reduced the amount of ROS produced in the brains of *C. elegans* expressing pan-neuronal Amyloid-beta, amino acids 1-42. Moreover, recent works explored the potential of antioxidants attenuating ROS. Ascorbic acid, commonly known as Vitamin C, is a potent antioxidant. Because humans lack the enzyme L-gulono-beta-lactone oxidase required for Vitamin C biosynthesis, we must look to our diet and supplements to prevent deficiencies. Imbalances are therefore likely attributed to ROS development. Hence, our work focused on hindering the interaction between copper and Amyloid-beta via chelation therapy with ascorbic acid and beta-alanine to reduce ROS production in the brains of *C. elegans*, and, in turn, minimize neuronal damage.

Diana Walkosz, Ameer Alharhashi, Nancy Reyes

Dr. Mallory Havens

53B Covalent Crosslinking of Cellulose-Based Hydrogels Utilizing Carboxylic Acid Derivatives for Enhanced Structural Integrity

Undergraduate Student Project in Natural Sciences

Crosslinking is vital for enhancing the properties (e.g., tensile strength, swell degree, functional groups, and pore structure) and functionality of biopolymers like hydrogels. Noncovalently linked hydrogels demonstrate structural instability due to weak crosslinking from hydrogen bonds, which restricts their potential biomedical applications. To achieve greater structural integrity, hydrogels can be covalently crosslinked. However, many covalently linked hydrogels employ organic crosslinking agents that are harmful to humans and the environment, such as glutaraldehyde. This study aims to explore natural carboxylic acid crosslinking agents for covalently linking hydroxyethyl cellulose (HEC) and carboxymethyl cellulose (CMC). Carboxylic acid derivatives including malonic acid, tartaric acid,

itaconic acid, fumaric acid, and maleic acid, were added in equal concentrations to a HEC and CMC solution before freeze drying. Each type of crosslinked hydrogel was characterized by evaluating the tensile strength, swelling capabilities, functional groups using Fourier transform infrared spectroscopy (FTIR), and analyzing pore structures with scanning electron microscopy (SEM). The effects of each acid on the properties of the hydrogels vary depending on their structure and any additional functional groups present. This research highlights the potential of carboxylic acid derivatives as safe organic covalent crosslinkers for hydrogel films that could be suitable for future biomedical applications.

Rebecca Ratajczyk
Contributors: Connor J. Keating, Ezra Samson, Katey M. Sheets

Dr. Jason Keleher

56B D62N Mutant NDM-1 Enzyme for Metallo-Beta-lactamase Inhibition Study

Undergraduate Student Project in Natural Sciences

One of the leading problems that is faced in the health industry today is antibiotic resistance. Bacteria have over the years developed a resistance to antibiotics through the presence of enzymes that cause antibiotics to be neutralized. A key enzyme against antibiotics are metallo-beta-lactamases. The method that these enzymes use is hydrolysis of the beta-lactam antibiotics. In order to combat these enzymes, mutants such as D62N of NDM-2 metallo-beta-lactamase are designed and then inserted into a vector. Once inserted into the vector it is expressed using *E. coli* cells. The mutation is then studied for protein function via characterization and assays. Through this the effect of the mutation is identified and amino acids that are crucial for the function and stability of the enzyme can be found. Once these mutants are created, inhibitors will be tested on them in order to further understand the effectiveness of the inhibitors and the function of the mutants. Results will be studied.

Ethan Scott

Dr. Kari Stone

59B Degradation of Methyl Orange Using Enzyme Crosslinked Silica

Undergraduate Student Project in Natural Sciences

Wastewater runoff from textile factories contain synthetic dyes that are harmful for the environment, creating a need for effective removal of these pollutants. Biochemical efforts involving enzymes allow for a more cost effective, and greener way of clearing out textile dyes. Chloroperoxidase (CPO) and Glucose Oxidase (GOx) are effective catalysts in nature that allow for the oxidation of compounds into those less harmful. Though, on their own these enzymes are beneficial, being able to degrade dyes in masses would fully harness the overarching power of these enzymes. Silica is a common compound found in nature that due to its relative stability can act as a vessel for CPO and GOx through crosslinking which allows for the diffusion of each enzyme in the presence of textile dyes, methyl orange in this study. Once enzymes are cross-linked, the surface area of the silica effectively increases allowing for a more reactive surface. These reactions can be monitored kinetically to view the action of the enzyme with the dye. Further characterization of the functionalized silica can be done to gain a deeper understanding of the surface area, pore size as well as IR and SEM functionalization to determine the capacity of the crosslinked enzymes.

Jacob Redwinski

Dr. Kari Stone

62B Developing an Apparatus to Measure Heat Radiated from Various Surfaces

Undergraduate Student Project in Natural Sciences

On a hot day, blacktop surfaces and artificial turf fields radiate a significant amount of heat, often raising surface temperatures to well above 120 degrees F, which can be harmful to people, especially when exposed to this heat for an extended time. This project aims to develop a device used to study the heat radiated off of different surfaces at various heights. The apparatus is a post with temperature sensors set a fixed distance apart. The low-cost temperature sensors are read out and recorded by an Arduino. The data are analyzed to examine temperature gradients above the surfaces being examined in order to provide a better understanding of how heat behaves on a more local level, such as parking lots, school playgrounds, or football fields. Ultimately, this understanding can be useful in determining what materials to use in different locations to mitigate local heat impacts and potentially other urban heat issues.

Robert Fudala, Sebastian Kandakudy

Dr. Joseph Kozminski

65B Enhancing Chemical Mechanical Planarization (CMP) Performance Through Catalytic Surface Oxidation of Wide Band Gap (WBG) Substrates

Undergraduate Student Project in Natural Sciences

According to Moore's Law, the number of chips on an integrated circuit (IC) must double every two years to meet the ever-growing demand for computing capabilities. Wide bandgap (WBG) substrates such as silicon carbide (SiC) and diamond are emerging as the optimal candidates to fulfill the rising technological needs due to their intrinsic characteristics, including high capacitance, thermal stability, and wear resistance. In the effective manufacturing of devices for high-power applications, each layer of the substrate must be atomically flat. To achieve this, a combination of chemical interactions and mechanical forces is employed in the chemical mechanical planarization (CMP) process. The benefits of these WBG substrates contribute to the challenges of CMP since the hardness of the material necessitates aggressive chemistries, such as harsh oxidizers, to obtain the desired material removal rates (MRR). The industry standard for achieving this oxidation and MRR is potassium permanganate ($KMnO_4$); however, this compound is harsh on the substrate, giving way to surface and subsurface defects. To mitigate these damaging side effects, hydrogen peroxide (H_2O_2)-based slurries show promise as alternatives, although they cannot achieve the required MRR on their own. H_2O_2-based slurries can be enhanced with the addition of an organometallic complex (OMC) to boost the generation of reactive oxygen species (ROS). Initial results indicate that the addition of an OMC aids in the production of ROS by almost 2.5x thus improving the redox potential of the slurry. In turn, the ROS help to increase the MRR making it comparable to that of $KMnO_4$.

Andrew Murphy, Amanda Warfield, Kiersten Smith
Contributor: Austin Rockaitis

Dr. Jason Keleher

68B Exploring the Potential for Antibiotic Resistance Developing in Bacteria Exposed to Allicin Derived Compound

Undergraduate Student Project in Natural Sciences

Antibiotic resistance is a pressing global public health crisis that undermines our ability to effectively treat bacterial infections. To combat this challenge, it is essential to investigate the mechanisms by which microbes develop resistance to antimicrobial agents, including natural compounds. Allicin, a bioactive sulfur-containing compound derived from garlic (Allium sativum), has demonstrated significant antibacterial properties, such as damaging bacterial DNA, disrupting cell membranes, and inactivating essential enzymes. Despite its potential, it is possible that bacteria can develop resistance due to overuse. Given widespread antibiotic use started in the 1950s, the long-term consequences of emerging bacterial adaptation to antimicrobial agents are a serious threat.

This proposal aims to explore the potential for bacterial resistance to allicin by culturing bacterial in media containing increasing concentrations of garlic powder (e.g., 0.1 mg/mL, 0.5 mg/mL, 1 mg/mL, 5 mg/mL, and 10 mg/mL), then determining susceptibility patterns. Next, the development of resistance in the bacteria will be examined in large Petri dish experiments using standard microbiological techniques as outlined in Baym et. al. (2017). If resistant strains appear, they will be characterized using standard techniques. If resistance mechanisms develop, they may mirror those observed with conventional antibiotics. Alternatively, bacteria may exhibit adaptive tolerance, leading to partial or complete resistance, which could compromise the long-term efficacy of allicin as a natural antimicrobial agent. The outcomes of this project may provide insights into the evolution of resistance to garlic-derived compounds used as antimicrobial agents.

Husam Aldajah, Mustafa Altamimi

Dr. Jerry Kavouras

71B Fabrication and Analytical Characterization of Nd:YAG Laser System

Undergraduate Student Project in Natural Sciences

Laser technology plays a pivotal role in a wide range of high-tech instruments across diverse fields, from scientific research to industrial manufacturing. Almost every modern technological application, whether in communications, medicine, or material processing, relies on lasers for their precision, efficiency, and versatility. Neodymium-doped Yttrium Aluminum Garnet (Nd:YAG) lasers, which emit infrared (IR) light, are particularly valued for their high efficiency and stability. Their ability to generate powerful, coherent beams makes them indispensable in industrial applications. This study aims to assemble an Nd:YAG laser system using commercially available components and established blueprints, focusing on optimizing the alignment process to ensure efficient lasing. While constructing a functional laser system is an essential first step, the primary challenge lies in the alignment to minimize energy loss and maximize performance. Misalignment can lead to mode instability, increased losses, and light scattering, resulting in an uneven beam profile and reduced system efficiency. Alignment is a frequent issue in malfunctioning laser systems in industrial settings, making it a critical factor for maintaining optimal laser operation. To evaluate the alignment quality, we employ a raster scan technique to map the spatial intensity distribution, providing valuable insight into the system's alignment sensitivity and energy efficiency. These findings contribute to a deeper understanding of laser alignment optimization, with implications for improving the performance of Nd:YAG lasers in various applications, including material processing, spectroscopy, and nonlinear optics.

Leonardo Ramos

Dr. Philip Chumbley

74B Inhibition Studies of Metallo-beta-lactamase NDM-5 Variant

Undergraduate Student Project in Natural Sciences

The emergence of antibiotic-resistant bacteria has created a new demand for antibiotics and inhibitors for the enzymes these bacteria use to defend against antibiotics. Some bacteria use metallo-beta-lactamases (MBLs) which have a unique mechanism for breaking the beta-lactam ring, a critical structure in some antibiotics. These MBLs are resistant to conventional inhibitors and, so far, no treatments are available. The characteristics of a strain of NDM-5, which contains mutations at M154L and V88L, will be explored and their susceptibility to inhibitors will be evaluated. The effectiveness of inhibitors on these mutant strains will be compared to their impact on the wild-type NDM-1. This study aims to identify inhibitors capable of targeting both wild-type and mutant NDM-1 enzymes. The results will be presented.

Elisa Morales

Contributors: Cole Johnson, Anthony Baudino

Dr. Kari Stone

77B Innate Immunity of Wild-Type and daf-2 *C. elegans* Worms When Treated with Berberine Chloride

Undergraduate Student Project in Natural Sciences

Caenorhabditis elegans, a type of roundworm, are a commonly used model organism in scientific research. They were the first multicellular organisms to have their DNA completely sequenced, and despite being invertebrates, have significant shared homology with vertebrates such as humans, making them excellent candidates for the drug development process and other experimental investigation related to human applications. The daf-2 gene in *C. elegans* worms is a critical regulator of insulin, aging, and defense against pathogens. Berberine chloride is the active ingredient found in a variety of herbs that have been used for over 2,000 years as a treatment for bacterial and fungal diseases. This research aimed to determine the role of berberine chloride in the *C. elegans*' lifespan and defense against pathogens. It was hypothesized that, being exposed to berberine chloride, both wild type N-2 and daf-2 mutant strains of *C. elegans* would be able to live longer when introduced to pathogens such as *S. aureus* and *B. megaterium*, presumably due to an enhanced antimicrobial environment. The treatment was achieved by suspending both strains of worms in liquid media infused with berberine chloride for 24 hours, with subsequent exposure to the chosen pathogens. Lifespan assays will be used to assess the overall impact of conditions on longevity, and assessment of gene expression will be used to determine whether the antimicrobial response to pathogens is altered by experimental manipulation.

Deni Gonzalez

Dr. Sarah Powers

80B Investigating the Effects of an Electron Donating Group on Radical Scavenging Ability of Edaravone

Undergraduate Student Project in Natural Sciences

Amyotrophic lateral sclerosis (ALS) is a disease that attacks motor neurons that effectively make one progressively lose motor functions. Reactive radical species within the body is one of the many mechanisms of the ALS disease state. People with ALS are unable to control increased radical species because natural antioxidant mechanisms are overwhelmed. To fight this, edaravone is a therapeutic drug that acts as a free radical scavenger to help people with ALS and limit concentration of radical species. To improve the effectiveness of edaravone radical scavenging abilities, functional groups are attached to the phenyl group of edaravone. The functional group changes chemical properties to improve or hinder radical scavenging abilities. To determine the effectiveness of attaching a methyloxy group in the para position a stable radical, DPPH, will be used. The edaravone derivative reaction rate with DPPH is compared to Vitamin C and edaravone. Results will be discussed.

Adam Makhlouf, Donald Hagemaster, Armani Vazquez, Zachary Maslona

Contributor: Adan Martinez

Dr. Kari Stone

83B Investigating the Effects of Vitamin C in Conjunction With Beta Alanine in *Caenorhabditis elegans* to Further Research on Alzheimer Disease

Undergraduate Student Project in Natural Sciences

Alzheimer Disease (AD) is a common neurodegenerative disease that affects the cognitive and motor skills of an individual. The main cause of Alzheimer's is aggregation of amyloid plaques in the brain. This begins when the amyloid precursor protein (APP), which is responsible for synaptic development, cell signaling, and neural plasticity, is broken down and creates beta-amyloid fragments. In Alzheimer's, the levels of zinc and copper can be abnormally high and can bind to the beta-amyloid fragments that can facilitate its aggregation in the brain. Furthermore, when the metal copper binds to the beta amyloid it can create reactive oxygen species (ROS) which can ultimately lead to neuronal death. There is no cure for Alzheimer's, but there are some medications that help minimize the symptoms of Alzheimer's by attempting to reduce the aggregation of amyloid plaques in the brain. *Caenorhabditis elegans* are an organism that is used to research Alzheimer's because of the similarities of their biochemical pathways and genes related to amyloid beta and tau proteins which are main components of Alzheimer Disease. In this study, Vitamin C is used on the *Caenorhabditis elegans* to further their lifespan by protecting the worms from oxidative stress. Beta alanine has been shown to increase the lifespan of *C. elegans* since it suggests that copper will bind to beta alanine instead of beta amyloid fragments which reduces the formation of reactive oxygen species. Therefore, there will be a series of tests done in C. elegans to determine the extent and how effective Vitamin C can be in conjunction with beta alanine.

Kathy Vicuna

Contributors: Diana Walkosz, Ameer Alharhashi, Nancy Reyes, Karen Ramirez, Gerry Cushing

Dr. Mallory Havens

86B Investigating the Non-Canonical Role of Cyclin D3 in Gene Regulation Using a Neutrophil Model

Undergraduate Student Project in Natural Sciences

Doherty Center for Aviation and Health Research

Cyclin D3 is recognized for its role in cell cycle progression. Previous research shows it also has a role in modulating gene transcription; however, cyclin D3 does not appear to directly associate with DNA, indicating that it likely influences gene expression through interactions with co-regulators. This research aimed to mechanistically understand cyclin D3's influence on gene expression during neutrophil differentiation by identifying affected genes and potential transcriptional partners it may modify or regulate. Using cultured HL-60 cells, gene expression profiles were compared between precursor (uHL-60) and differentiated neutrophil (dHL-60) cell populations using quantitative PCR, with the hypothesis that ectopic cyclin D3 expression

in uHL-60 cells would induce target gene expression patterns like those observed in dHL-60 cells. In other experiments, the RUNX-CBF? transcription factor complex was inhibited, hypothesized to be required for cyclin D3 to influence the expression of known target genes. A final approach will use luciferase reporter assays to evaluate regulatory regions of the MYC gene in the presence of cyclin D3. If one of these regions is regulated by cyclin D3, this approach could elucidate transcription factors cyclin D3 modulates as a co-regulator. Preliminary results indicate that cyclin D3 drives certain genes toward a differentiated-like expression state while not influencing other genes. Its regulatory activity does not depend on the RUNX-CBF? complex for investigated target genes. Collectively, this work contributes to an understanding of the basic mechanism behind cyclin D3's influence on gene expression.

Aaron Allred

Dr. Sarah Powers

89B Metal Sequestration using *Pseudomonas putida* MnB1 BMO Encapsulated Calcium Alginate Beads

Undergraduate Student Project in Natural Sciences

Pseudomonas putida MnB1 is a bacteria that uses multicopper oxidases to catalyze manganese oxidation. MnB1 forms biogenic manganese oxides (BMO) which uptake Mn(II) and facilitate the water oxidation catalysis of Mn(II) into Mn(IV). BMO-mediated sequestration of various metals in aquatic environments has been shown to lead to the ability to remediate heavy metals in water, an ongoing health problem that threatens human health and water quality. BMOs are capable of absorbing a variety of metal ions to catalyze this reaction. In this study, MnB1 was cultured and transferred to growth media to produce BMOs. BMOs were encapsulated in alginate hydrogel beads. The metal content of water remediated by BMO was characterized using atomic absorption spectroscopy. Results will be discussed.

Genesis Dennis

Contributors: Elisa Morales, Cole Johnson

Dr. Kari Stone

92B Minimizing Corrosion in Post-CMP Cleaning: Innovative Spray Bar Designs for Low to Zero Oxygen Chemistries

Undergraduate Student Project in Natural Sciences

Due to the rapid advancement of semiconductor materials, the demand for high device reliability and efficiency has significantly increased. Chemical Mechanical Planarization (CMP) ensures components achieve angstrom-level precision for device reliability. Mechanical and chemical defects can occur during the CMP process, creating the need for post-CMP processes. The post-CMP process removes residue and defects from the substrate using mechanical and chemical methods. A brush rotates across the surface of the substrate while nozzles distribute cleaning chemicals onto the surface. These chemical defects may include scratches and corrosion caused by oxygen molecules dissolved in the cleaning agents interacting with the substrate surface. This interaction induces an electrochemical reaction that generates imperfections on the surface, drastically reducing semiconductor efficiency. To mitigate this corrosion effect, studies on cleaning processes have focused on removing oxygen molecules from the cleaning chemistry before and during the cleaning by purging agents at the nozzle. Various nozzle designs are explored to produce low to zero oxygen cleaning chemistries when they interact with the surface. By analyzing the oxygen concentration and reclamation in the cleaning chemistry from different nozzle designs, along with shear force data on the Coefficient of Friction (COF), the effectiveness of the spray nozzles with low to zero oxygen can be evaluated.

Steven Roberts

Dr. Jason Keleher

95B Modulating Oxygen and Water Diffusion in Carboxymethyl Cellulose Hydrogels Crosslinked with Different Acids for Improved Wound Healing

Undergraduate Student Project in Natural Sciences

Hydrogels offer a versatile and innovative approach to wound treatment due to their hydrophilic three-dimensional structure. These gels are already utilized in medical applications to maintain moisture in lesions. Their hydrophilic properties grant hydrogels an impressive ability to absorb large volumes of water. These hydrogels are created using chemical crosslinking agents (e.g. citric acid) that stabilize the gel network, influencing the structural integrity and resilience of the gel. The production of these hydrogels incorporates alternative acid additives such as citric, malonic, maleic, fumaric, tartaric, and itaconic acids. The inclusion of these various acids affects ester linkages within the gel; moreover, these hydrogels are characterized by varying pH levels that modify the gel's structure and properties through different functional groups. To assess the performance of these hydrogels, oxygen saturation levels (%O2) were measured using a plastic chamber with a compartment containing the gel. These results were compared with our previous findings on pore size and circularity to identify potential trends. Additionally, the water contact angle (?) was analyzed using a converging lens and a Casio High-Speed Exilim Digital Camera, with the gel positioned on an elevated stand to capture video footage of water droplets interacting with its surface (e.g. the Carboxymethyl Cellulose citric acid hydrogel displayed a reduced contact angle under acidic conditions). This research advances hydrogel technology by providing valuable insights into customized hydrogel dressings for wound healing applications.

Ezra Samson

Contributors: Rebecca S. Ratajczyk, Connor J. Keating, Katey M. Sheets

Dr. Jason Keleher, Dr. Mallory Havens, Dr. Sarah Powers

98B MWCNT Carbon Composites Reinforced with MOFs for Sports Equipment

Undergraduate Student Project in Natural Sciences

Faculty Scholar Award

Carbon fiber reinforced composite materials have become a crucial component of sports equipment due to their high strength-to-weight ratios. Carbon nanotube composites in particular are commonly found in bicycle frames, baseball bats, and lacrosse sticks in addition to other sports materials. Development of advanced carbon nanotube polymeric composites with enhanced stabilities and strength is an active area of materials science research. This investigation reports on the composition of novel composites containing multi-walled carbon nanotubes (MWCNTs) and metal-organic frameworks (MOFs) and their strengths. Composites were fabricated using a resin 3D printer containing different ratios of MWCNTs and MOFs. The best performing composites were identified by measuring the force required to break the material and determining tensile strength.

Catherine Roney

Dr. Daniel Kissel

101B Optimizing Post-CMP Cleaning: Reducing Oxidation in Metal Substrates via Nitrogen Purging

Undergraduate Student Project in Natural Sciences

Chemical Mechanical Planarization (CMP) is essential in semiconductor manufacturing, integrating chemical reactions and mechanical abrasion to achieve atomically flat surfaces with minimal defects. Post-CMP cleaning utilizes PVA brush scrubbing with platen-brush rotation and chemical injection to eliminate excess material. Current cleaning solutions are high-pH alkene-based but risk substrate oxidation, leading to corrosion and diminished reliability. Oxide formation offers an easy pathway to alter the substrate structure, which is undesirable during the cleaning step. To minimize oxide formation, oxygen in the cleaning chemistries must be reduced or eliminated, achievable by purging with nitrogen gas. Four different cleaning chemistries are studied alongside the substrates: Tungsten, Copper, Tantalum, and Molybdenum, to assess and compare the effectiveness of the purge process. This is evaluated through mechanistic studies like the dissolved oxygen hysteresis kinetics to analyze the lifespan of low dissolved oxygen content. The same method is applied using the focal instrument, the chemistry injection system. Additionally, electrochemistry studies simulate the interactions between the solution and the substrate by applying increasing electric current. The resulting data correlates with the solution's capacity to induce oxidation on the substrate during the cleaning process. Comparing the solutions in purged

and unpurged states using electrochemistry provides insights into their cleaning abilities; the performance of the cleaning chemistry is quantified by the coefficient of friction (COF) and defect removal efficiency.

Carly Shipman
Contributor: Steven Roberts

Dr. Jason Keleher

104B Project W.A.T.C.H (Water Antigen Tracking with Cellulose Hydrogels): A Biopolymeric Scaffold for Advanced Sensing Applications

Undergraduate Student Project in Natural Sciences
Doherty Center for Aviation and Health Research

There is a critical need for real-time, efficient, and environmentally sustainable biosensors for monitoring water quality. Current techniques rely on off-site static measurements, necessitating expensive materials that create delays between sample collection and analysis. An appealing material is cellulose hydrogels due to their porous structure and ability to be made conductive. The functional groups (i.e., carboxymethyl and carboxyethyl) on the cellulose backbone enable it to serve as a biopolymeric scaffold suited for prolonged submersion in aqueous media. The addition of covalently conductive nanoparticles (CCNP, such as TiO2) into the matrix enhances its functionality, allowing for surface modifications, including the attachment of immunoglobulins. Immunoglobulins (IgG) are molecular probes used for the recognition and binding of antigens (i.e., viral and bacterial toxins) because of their highly specific binding properties. The proposed attachment of silane-treated TiO2 would form a covalent bond with IgG, facilitating the identification of specific molecular signatures from highly complex mixtures. Project W.A.T.C.H aims to provide a scaffold with IgG-CCNP embedded in the hydrogel, ensuring specificity. When antigens bind to IgG-CCNP, the complex generates a measurable signal in the form of energy emission (i.e., redox or fluorescence) that could be detected. This signal would be directionally funneled to an electrical transducer that amplifies and processes it for reception via a Bluetooth sensor.

Jadyn Dominguez, Aine Ronan
Contributor: Connor Keating

Dr. Jason Keleher, Dr. Sarah Powers

107B Silence of the Genes: Truncation of ATXN3 Serves as a Viable Treatment for Spinocerebellar Ataxia Type 3

Undergraduate Student Project in Natural Sciences
Doherty Center for Aviation and Health Research

Spinocerebellar Ataxia Type 3 (SCA3), colloquially known as Machado Joseph Disease (MJD), is an autosomal dominant neurodegenerative disorder. Ataxia in the name referring to the most prominent clinical presentation of impaired motor ability. The mutation passed down the familial tree is an elongation of the polyglutamine (polyQ) repeat found in exon 10 of the Ataxin 3 gene. This excess in glutamine causes the resulting protein to misfold, resulting in an insoluble product that aggregates around neurons leading to neuronal death. Currently there is no cure. One avenue of exploration is gene therapy, in this case modulating the RNA processing so that the problematic section is removed, resulting in a truncated protein that would exhibit wildtype functionality. One method of accomplishing this is through the use of antisense oligonucleotides (ASOs) which can bind to pre-mRNA, altering the maturation process—particularly during splicing. Researchers believe that they can use ASOs to prevent the inclusion of exon 10—or a portion of it—in the mature mRNA, resulting in a truncated protein that does not aggregate. This work explores a multitude of published works that explore the use of such gene therapies on SCA3, as well as other polyglutamate repeat diseases, to support the viability of alternative splicing as a possible therapeutic deserving of additional exploration. This work also explores the viability of skipping in an experimental C. elegans model of the disease.

Allan Victor Cortes

Dr. Mallory Havens

110B Synthesis of Mixed Metal Organic Frameworks Using Post Synthetic Metal Ion Exchange

Undergraduate Student Project in Natural Sciences

Metal organic frameworks (MOFs) are porous materials that have proven successful in different applications such as catalysis, drug delivery, and CO2 capture amongst others. Typically, these materials are made with a metal node and an organic ligand. However, there has been little research into the properties regarding MOFs with multiple metal nodes. In this study, post synthetic metal cation exchange (PSME) will be used to add a second metal node to the framework of various MOFs. This process has been used to fully exchange metal nodes with metals that do not align with the traditional MOF synthesis. In these works, the ion exchange has been explored for both complete metal exchange and partial exchange; this work will present on partial metal exchange. MOFs featuring MIL and UiO frameworks have been subjected to PSME using titanium and other metal ions to determine how PSME influences MOF properties. Characterization of each modified MOF was carried out using surface area analysis, SEM/EDS, ATIR, and pXRD in comparison to their monometallic counterparts.

Amanda Anderson, Eve Garvey

Dr. Daniel Kissel

113B The 4-Fluoro Derivative of Edaravone is Investigated for ALS Therapy

Undergraduate Student Project in Natural Sciences

Edavarone is used to treat patients with ALS in order to slow the progression, however, what studies have not shown is the effects of the 4-fluoro derivative as one of the treatments for the disorder. ALS is a neurodegenerative disease where a person's muscle to brain connection is lost, in most cases being fatal. As of now there are four medications approved by the U.S. FDA used to treat ALS, however, there is no cure for the disease. One of the most effective treatments is Radicava, aka Edavarone, whose derivatives are still not understood as ALS therapies. The radical scavenging ability of the 4-fluoro derivative as well as its copper chelating ability will be analyzed.Results will be discussed.

Ashley Vargas, Hagen Arriaga, Jessica Predkelis, Nifemi Amubiaya

Dr. Kari Stone, Adan Martinez

116B Evaluation of Cyclin D3-Mediated Transcriptional Regulation of Mono-Allelically Expressed Genes During Neutrophil Differentiation

Undergraduate Student Project in Nursing & Health Professions
Doherty Center and Brother Bernard Rapp Research Focus Awards

Cyclin D3 is known for its role in the cell cycle as it regulates the transition from the G1 phase to the S phase. It also behaves as a transcription regulator; however, cyclin D3 does not directly bind DNA, and the precise mechanism of how cyclin D3 controls (activates or represses) gene expression has not yet been determined. The HL-60 cell is a standard model for observing the development of human neutrophils and was used to understand the role cyclin D3 has as a transcription regulator as neutrophils differentiate. This study evaluated mono-allelically expressed genes, selected from a previously published set of genes that were believed to be sensitive to cyclin D3 regulation, and hypothesized that the presence of cyclin D3 would affect the expression of selected targets. The six mono-allelically expressed genes of interest were LipC, Tmc5, Efna5, Zfhx4, Pcdhb14, and Leprel1. RNA-sequence data available on the ImmGen platform was used to predict whether expression levels of the candidate genes should increase or decrease during neutrophil development. Predictions were then tested using the HL-60 cell system, in which gene expression from precursor cells (uHL-60) and differentiated neutrophils (dHL-60) could be compared to HL-60 cells with ectopic expression of cyclin D3. Quantitative PCR was used to evaluate the expression of the genes of interest. This presentation will report whether cyclin D3 activates, represses, or does not impact gene expression of mono-allelically expressed genes during neutrophil differentiation.

Fatima Sohail Warraich

Dr. Sarah Powers

POSTER SESSION C

THURSDAY • APRIL 24

3:30–4:30PM

FIELDHOUSE

3C How Does Aviation Maintenance Education Affect Future Career Opportunities?

Graduate Student Project in Aviation

The purpose of this study is to investigate whether earning a bachelor's or master's degree in aviation provides faster career advancement and greater earning potential for aircraft maintenance technicians (AMTs). The aviation industry is highly specialized, and AMTs are essential to ensure the safety and functionality of aircraft. Traditionally, AMTs often enter the field with certifications and work experience, but formal training beyond these certifications can provide additional career benefits. This study aimed to evaluate how degree impacts career progression by analyzing industry data and surveying AMTs with different levels of formal education. The study will focus specifically on factors such as promotions to management positions, opportunities to access specialized positions, and the speed with which these advancements occur. In addition, the study will explore the relationship between education level and income. While AMTs can command a competitive salary based on certification and experience alone, earning a higher degree can open the door to management and strategic positions that typically command higher salaries. This study has important implications for AMTs considering further education and for employers trying to understand the value of formal educational credentials within their workforce. The results provide insight into whether investing in an aviation degree is a strategic move for career growth and financial advancement in the aviation services industry. Ultimately, this study aims to contribute to the ongoing discussion regarding the intersection of education, career development, and compensation in the aviation industry.

Bryan John Salcepuedes, Zaid Tadros

Contributors: Zaid Tadros, Vamsi Kesana

Dr. Erik Baker

6C Perceived Effects of Fatigue on Collegiate Certified Flight Instructors

Graduate Student Project in Aviation

In the aviation sector, instructor fatigue is a growing issue, especially for Certified Flight Instructors (CFIs) who manage dual responsibilities for student safety and their own performance. This study explores the relationship between demographics, workload, and sleep patterns that contribute to CFI fatigue at Lewis University's Part 141 flight school, along with the perceived impact of fatigue on safety culture, instructional quality, and operational errors. AC 120-100 Basics of Aviation Fatigue defines fatigue as "a physiological state in which there is a decreased capacity to perform cognitive tasks and an increased variability in performance as a function of time on task." Data was collected through an anonymous electronic survey of 14 CFIs at Lewis University in Romeoville, IL, yielding 14 responses, with CFIs rating fatigue's effect on performance across various aspects. CFIs at Lewis University face frequent fatigue from long hours, heavy workloads, and poor sleep, impacting instructional quality and increasing errors. A lack of supportive policies discourages addressing fatigue, with recommendations for a five-day workweek, structured breaks, and clearer fatigue management policies. Through the analysis of these findings, the study hopes to offer insightful information that might help develop better methods for handling teacher tiredness and, in turn, raise the bar for safety in aviation training. The findings will be shared with important aviation industry players and academic institutions in order to influence changes to regulations and the development of best practices in fatigue management.

Ryunosuke Takama, Cristina Tabora, Ryo Hayakawa, Aswin Daki, Vamsi Mamillapally

Dr. Erik Baker

9C The Need for Preventative Safety Measures, an Analysis of Aviation Safety Reports and Loss of Separation Events

Graduate Student Project in Aviation

This study aims to analyze the frequency of collision hazard reports that are submitted through the ASAP reporting system to potentially show more hazardous locations near the Lewis University Airport . The research specifically will investigate whether or not there are certain approach paths or runways that are associated with a higher incidence of collision hazard reports. This will help to identify potential hotspots for arriving and departing traffic. Through the use of the ASAP reporting system provided by Lewis University, the research will provide a visual analysis to show the location within the traffic pattern where reports are more frequent. By examining the distribution of ASAP reports in relation to traffic direction and runway usage, this study looks to create a better understanding of what the operational risks and what safety improvements could occur for Lewis University Airport.

Jenna Cipriani, Ronald Fishleigh, Matthew Vineyard, Miguel Turcios, Vamshi Gurram

Dr. Erik Baker

12C Offender Reentry Program in a Rural Community: Process and Substantive Evaluation

Undergraduate Student Project in Education & Social Sciences

Over the past decade, offender reentry has been one of the priorities for state and federal corrections (Whetzel and McGrath, 2019; Mellow and Christian, 2008). Much of the research was done in urban and suburban areas (Station-Tindall, McNees, Leukefeld, Walker, Oser, Duvall, Thompson and Pangburn, 2011; Leftridge Byrd, 2008; Frazier, 2013). This Re-Entry Program is located in Southern Illinois and is designed to support individuals transitioning from incarceration back into the community. The Program provides resources and services, including housing assistance, employment support, education and training, health and wellness services, and life skills development. The primary focus of this program is housing, usually one of the top priorities and barriers for successful reentry (LeBel, 2017; Walker, Hempel, Unnithan, and Pogrebin, 2014; Whipple, Jason, and Robinson 2016). The process evaluation will be a two-prong approach. First, and examination of documents, including project planning meetings, to explore the goals and procedures. Second, interviews and focus groups through a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis, of advisory board members and key staff to examine the perception of the process (Knollenberg and Martin 2008). The process evaluation will lead to community-based needs assessment and substantive evaluation (Lebel, 2017; Nhan, Bowen, and Polzer, 2017).

Victoria Paugys

Dr. Morris Jenkins

15C Animal Assisted Therapy and the Geriatric Community

Undergraduate Student Project in Education & Social Sciences

Animal-assisted therapy has proven to be effective with children in various contexts, however, there is not as much research examining the possible benefits of this intervention with older adults. Some research has found a link between the use of therapy dogs, a decrease in agitated behaviors, and an increase in social interactions among older adults (Palley, 2010). The current study will examine the effect of therapy dogs on depressive symptoms among older adults residing in a nursing care facility. A questionnaire examining depressive symptoms will be given to participants before and after their interaction with the therapy dogs. Results will be analyzed using SPSS. It is expected that exposure to therapy dogs will decrease depressive symptoms within this population.

Alexa Acevedo

Dr. Lorri McMeel

18C Beethoven to Birds: Investigating the Impact of Music and Nature Sounds on Working Memory Performance

Undergraduate Student Project in Education & Social Sciences

Several studies have been done regarding the relationship between background auditory sounds and working memory in various populations. Additional research has also discussed "The Mozart Effect" which explains that classical music can be beneficial to short term cognitive processes. The aim of this research is to enhance the understanding of the effect that different music types and auditory experiences have on working memory function in college students. This experiment will consist of college students coming to a classroom to listen to the various auditory stimuli's and completing a brief working memory test for each experience. To account for the possible impact of arousal, silence will also be a condition. To measure working memory we plan to use a cognitive memory test during each auditory experience. After the participants have completed all tasks, a rating scale regarding all the auditory and music types will be given to measure the role that emotional reactions could have had on shaping cognitive efforts.

Sydney Anderson, Jillian Staffeldt, Edgar Martinez

Dr. Matthew Domico

21C Discovering the Correlation Between Heavy Social Media Use and Increased Anxiety in College Students

Undergraduate Student Project in Education & Social Sciences

This study hopes to investigate the impact that heavy social media use has on anxiety rates in college students. A randomized sample of 100 participants will be conducted to assess the amount of time spent on a platform, the level of anxiety one exhibits, and what the core root of their anxiety is. Heavy social media use will be defined as spending more than 90 minutes on the social media platform per day. Anxiety levels will be collected through a self-anchored scale and the GAD-7 anxiety scale.

Skylar Sones

Dr. Lorri McMeel

24C Domestic Violence in the Families of LGBTQ Law Enforcement

Undergraduate Student Project in Education & Social Sciences

There is a common culture amongst law enforcement that puts people in the LGBTQ community in a negative connotation. Historically, being a homosexual used to be a crime, making the modern relationship amongst LGBTQ people and police, in the modern context, strained and distrustful. The additional stigma the LGBTQ community suffers from society as a whole puts their relationship and family at a higher risk for domestic violence. Like with any minority community, microaggressions and homophobic stereotypes from society become internalized in an individual, and in the context of a relationship, those views can be reflected onto a partner. These dynamics put LGBTQ law enforcement at a particularly high risk, especially considering law enforcement families also suffer higher recorded rates of domestic violence when compared to the general population. There is a culture of aggressive and authoritarian behavior that is common amongst more traditional policing, putting officers at risk to carry that behavior into their everyday lives. Combined with the stigma they must face from their own justice system, and the homophobia they absorb from society, LGBTQ officers are at a dangerous intersection of these two warring groups, suffering risk factors at both ends. This makes the scenario of an officer with a gay or lesbian partner all the more likely.

Brynn Koehler

Dr. Stephen Sherwin

27C Exploring Voting Behavior Among Immigrant Populations: A Focus on Amnesty and Refugee Status Influence

Undergraduate Student Project in Education & Social Sciences

This research explores the impact of limited resources on voter registration for naturalized citizens, with a focus on the Syrian Community Network (SCN) in Chicago. The study investigates whether a lack of resources at SCN affects their ability to provide necessary information and support to asylum seekers and refugees who have obtained naturalized status. SCN, a nonprofit organization dedicated to helping refugees and immigrants, offers essential services such as legal aid and education. However, it faces challenges in delivering voter registration workshops due to a lack of resources and hesitations about confusing non-naturalized clients. Through qualitative research, structured interviews were conducted with members of SCN's Immigration Division, including immigration attorneys and the director of the Education Division at SCN. The findings reveal that SCN struggles to provide adequate voter registration assistance due to limited staff, funding, and concerns about potential confusion among clients. The study also identifies the need for collaboration with other SCN divisions to create a comprehensive program that better addresses voter registration for naturalized citizens. Future research will focus on interviewing naturalized citizens directly to gain deeper insights into their knowledge and challenges related to voting. Ultimately, this study aims to improve the support provided to naturalized citizens and enhance their participation in the democratic process by addressing the resource limitations at SCN.

Zina Mahrat

Dr. Morris Jenkins, Dr. Huma Zia

30C Is It All in Your Head? Evaluating the Influence of Hemispheric Specialization on Cognitive Tasks

Undergraduate Student Project in Education & Social Sciences

Pseudoscience is the presentation of material, with a shred of truth to it. One such example in the field of psychology is the "left versus right brain myth". While loosely based on neuroscience findings, the idea of being dominated by one hemisphere is not supported by research. This study intends to extend previous work on pseudoscience beliefs by determining if receptivity can influence behavior. To address this question, participants experienced a mock personality quiz, where they were randomly assigned to one of four conditions: 1.) a "real" left brained condition where they received information about what tasks individuals that are left brained excel at and struggle with, 2.) an "inverse" left brained condition which included information about what tasks a right brained individual excels at and struggles with, 3.) a "real" right brained, or 4.) an "inverse" right brained condition Following this, all participants will take part in two cognitive tasks, the Cognitive Reflection Task (CRT-7) and the Alternative Uses Task (AUT). It is anticipated that individuals in the left or right-inverse conditions will have more analytical responses on the CRT-7while individuals in the right or left-inverse condition will have higher fluency and originality scores on the AUT. In addition, we anticipate that these results will be more likely to be observed in individuals who indicated higher receptivity to the myth. The current study hopes to extend previous work on pseudoscience beliefs by providing evidence that beliefs in pseudoscience can influence behavior related to the topic of that pseudoscience.

Sydney Brown

Dr. Philip Blankenship

33C Mind Over Matter: Investigating the Relationship Between Self-Talk and Athletic Performance

Undergraduate Student Project in Education & Social Sciences

Student athletes face many challenges on a day to day basis. Between balancing class work, friends, and athletics, it can take a big toll on their mental health. On top of that these athletes face challenges in their own sport whether it be imposter syndrome or just being in a rut. The purpose of this research study is to observe the effects of positive self-talk on depression, anxiety, stress, and athlete burnout. Data will be collected by distributing online surveys to student athletes at Lewis University, assessing their use of self-talk and levels of depression, anxiety, and stress. The assessments will be used to examine how the effects of self-talk can affect the student athletes' levels of depression, anxiety, and stress as well as athlete burnout. This research aims to provide valuable insights into potential benefits of mental conditioning through affirmations and positive self-talk in enhancing overall mental health. Additionally, the study will explore how the lack of affirmations and

negative self-talk might negatively affect an athlete's mental health. This creates a comparison between those who do engage in positive self-talk and affirmations versus those who do not.

Kenadee Pitchford, Sarah Newberry, Meghan Bandy

Dr. Matthew Domico

36C Navigating Transitions: Prison Closure on Correctional Personnel

Undergraduate Student Project in Education & Social Sciences

Over the past few decades, there have been many studies examining the stress on individuals who work in correctional institutions around the world. (Black, 2001; Bucerius, Schultz, and Haggerty, 2023; Haynes, Leone, Keena, May, and Lambert; Jayawardene, Kumbalatara, Jones and McDaniel, 2024, Michel, Kotrba, Mitchelson, Clark and Baltes, 2011; St. Louis, Monteiro and Frost, 2023). In fact, Principal Investigator Morris Jenkins has been involved in both domestic and International Studies about stressors with correctional officers (Elechi, Lambert, Out, Hall, Warner, Jenkins, Lanterman, 2023, Hogan, Lambert, Jenkins, and Wambold, 2006; Jenkins, Lambert, Elechi, Hall, Out, Lanterman and Barrington, 2023). Most of the domestic studies used quantitative methodologies, however, qualitative methods have been used to delve deeper into the issue of stress with correctional personnel (Rania, Migliorini and Coppola, 2020). Much of the internal stressors revolved around the distrust of the system (Hayes, et al, 2020, Page, 2011). The stressors had their foundation in the changes within the system (St. Louis, et al, 2023). Thompson (2011) found that changes, including downsizing and layoffs, had a negative impact on correctional workers. We will explore what type of impact the closing of Statesville had on correctional workers.

Setting: Electronic interviews through Zoom. Cameras will be off during the interview. When given the Zoom invitation, participants will be given an identifier that will be used during the interview.

- Dates: December 2024-November 2025
- Subjects: 25 correctional officers over the age of 18. Participants were recruited through word of mouth from connections with had at Statesville.
- Permission: verbal consent
- Procedures: 30 minutes interview
- Risks: risks are minimal however, there is a possibility of emotional/psychological risk, loss or breach of confidentiality, or stigmatization. Participants will be informed of these risks.
- Some of the questions asked may be upsetting, or you may feel uncomfortable answering them. If you do not wish to answer a question, you may skip it and go to the next.
- Some of the questions asked may make you angry, emotionally upset, or stressed out now or at a later time. If you do not wish to answer a question, you may skip it and go to the next question.
- There could be a risk of discomfort and harm (to the psyche, reputation, employability, insurability, social status, criminal or civil liability) that may occur as a result of participation. If you do not wish to answer a question, you may skip it and go to the next question.

Norah Obinyan

Dr. Morris Jenkins, Dr. Huma Zia

39C Provocation within Education

Undergraduate Student Project in Education & Social Sciences

Faculty Development Research in the Scholarship of Teaching and Learning

Select student teachers (6-8) will explore materials and offer provocations to young children in an early learning setting. The student teachers' will then collect work samples from children and their own field notes to analyze, interpret, and plan next steps in this science inquiry project. This project aims to dive into the creativity and opportunity to learn with the world around us how learning can be more profound than watching videos or writing on paper and copying; learning can be an experience, not a dreadful memory and we want to explore and document of what that entails.

Janelle Williams, Juana Reyes

Dr. Juana Reyes, Kristin Brizzolara

42C Somebody's Watching Me: Behavioral and Cognitive Changes from a Peripheral Presence

Undergraduate Student Project in Education & Social Sciences

There is a common feeling that most people have – a sense of being watched indirectly, constituting the notion of a "peripheral presence". Upon looking in that direction, their suspicions are correct. This feeling has been studied in various ways, but none have actually looked into how this influences focus and anxiety. The current investigation attempts to evaluate the influence of a "peripheral presence" on task performance, task focus, and feelings of anxiety. While no previous work has directly examined the notion of a peripheral presence, other work has observed that when individuals are presented with stimuli associated with being watched (eyes or a camera lens), they report increased feelings of anxiety or intensity that may influence task focus. The current study features participants in a repeated measures design where individuals take a reading test, either in the presence of another individual in their periphery or alone. Following the test, individuals will indicate their levels of intensity and task focus, as well as task performance being recorded. By the end, they will have their heart rate measured to further indicate the level of intensity. In future studies, researchers could focus more on biological influences that contribute to the sense of being watched.

Alberto Vazquez, Paige Mathis

Dr. Matthew Domico

45C Temperature's Toll on Sleep's Control: The Role of Environmental, Psychological, and Physiological Factors on Sleep Quality

Undergraduate Student Project in Education & Social Sciences

This correlational study will aim to identify the association between environmental, psychological, and physiological variables and sleep quality. The variables that will be present in this study include screen time, mental health, caffeine intake, and room temperature. Previous research suggests that there is a link between these factors and the overall sleep quality in individuals. It additionally indicates that cooler temperatures can improve one's sleep quality as well. In order to measure one's screen time and caffeine intake in this study, a self-reported survey will be given. Following this, the study will measure mental health by utilizing the Mental Health Inventory-5 (MHI-5) questionnaire. The study will also use a device that measures the temperature of the participants room throughout the night. All of these factors will be tested and compared to the data collected regarding the participants' sleep quality. In order to effectively measure each participant's sleep quality, each participant will complete the Pittsburgh Sleep Quality Index. In all, this correlational study will examine the relationship between various variables and it is expected to identify a negative correlation between room temperatures and quality of sleep.

Gabriela Stanisz, Addison Eltrevoog

Dr. Matthew Domico

48C The Gender of Personal Protection

Undergraduate Student Project in Education & Social Sciences

The perception of safety and safety precautions vary between men and women. Women are more aware of safety concerns in various settings compared to males. Women avoid potentially threatening activities that a male may find unthreatening, install home security systems, and exhibit a fear of victimization. They experience harassment, interpersonal abuse, stalking, or threatening behaviors and women are more likely to avoid public transportation at night due to feeling unsafe. These perceptions can affect how an individual is taught about personal safety. This study compares how different perceptions of safety are affected by gender, as well as how each gender's perception of safety affects how they navigate day to day situations. An online survey will be utilized to measure differences between how men and women perceive safety, how they navigate their environment, and when they were taught about personal safety. Participants should be at least 18 years old and should be composed of both male and female participants. The minimum number of participants for this study is 100 people. The participants will fill out the consent form then complete the survey. The only material required is an electronic device to complete the survey. The benefits of this study are to learn how the different genders behave in certain situations and how their gender affects safety perceptions. Future research will include safety

perceptions of individuals of different cultures, races, and social economic status. Results will be made available by December 2024, or following the completion of data collection and analysis.

Giustina Zindle

Dr. Spencer Campbell

51C The Write Choice: How the Influence of Class Structure and Note Taking Styles Can Impact Retainment and Engagement

Undergraduate Student Project in Education & Social Sciences

With the technological advances in recent times, digital notes have become ever more prevalent for college students across universities. Students are developing preferences for different forms of note taking and the class modality type. It is controversial among researchers whether handwritten notes provide a better understanding of course materials when compared to typed notes (Crumb, Roni M., et al, 2022). This becomes increasingly debated, especially with the shift of more classes being available online. This study aims to determine whether handwriting or typing notes in an online or in person setting influences engagement level and recall ability of lecture content. The current study will be a factorial design that measures both recall ability and engagement level between two groups. Lewis University undergraduate students will be assigned to either handwrite or type notes on a type of academic material in a lecture or online format. They will be given a test to measure their retention and engagement level. Previous studies have looked at the impact that the type of course has on understanding and recalling the information as well as the differences in handwriting ones notes and taking notes digitally. This current study will expand on the ideas of both, combining them to understand how the new age of technology affects one's engagement, understanding and recall ability.

Angel Rubalcava, Luke Crandall, Victoria Lauffer

Dr. Matthew Domico

54C Undocumented Individuals and Restorative Justice: Proposing A Model Fostering Inclusivity, Integration, and Mutual Benefit

Undergraduate Student Project in Education & Social Sciences

This study proposes a restorative justice model for undocumented individuals, promoting belonging, social cohesion, and shared progress. It explores how restorative justice can serve as a humanistic and equitable alternative to punitive immigration enforcement by emphasizing cooperation between undocumented individuals and their communities. This qualitative research study will focus on approximately five restorative justice scholars/practitioners to explore and integrate a restorative justice model for individuals whose only legal violation is being in the country without proper documentation or authorization. Through in-depth discussions, the focus group will assess and propose a restorative justice framework tailored to individuals who have resided in the country and are actively embedded within their communities. By centering the perspectives of restorative justice scholars/practitioners, this study seeks to develop a community-based, justice-oriented approach that acknowledges the lived experiences of undocumented individuals while fostering pathways for accountability and inclusion. Findings from the focus group discussions will inform a proposed model that prioritizes reconciliation, community engagement, and the principles of restorative justice as an alternative to traditional punitive immigration enforcement. I anticipate that the focus group will endorse a restorative justice model promoting community integration and alternative legal pathways. I expect that restorative justice practitioners will emphasize cost savings and will encourage community participation. The integration of restorative justice into immigration policy provides a legal and promising response to a complex issue that has yet to be addressed.

America Lopez-Buendia

Dr. Huma Zia, Dr. Morris Jenkins

57C Unmasking the Hidden Impacts of Social Media: Coping Strategies, Well-Being, and Productivity

Undergraduate Student Project in Education & Social Sciences

Social media has become a dominant tool for coping with stress, anxiety, and boredom. The usage of social media platforms has dominated college campuses across the country, while some students utilize social media for community, mental health resources, emotional support, or engaging with uplifting content others rely on social media as an escape. This can be seen by students' decreased productivity in the classroom, procrastination of assignments, reduction of connections, and intensified psychological distress. This study intends to explore social media use as a coping mechanism, analyzing its effects on emotional well-being, and productivity. There will be a concentration on different usage patterns (e.g., passive scrolling vs. active engagement), the type of content consumed, and how platform choices influence emotional regulation and cognitive functioning. Additionally, research will consider key moderating factors such as gender, major of the participant, and algorithm-driven content exposure, to determine their impact on stress relief and their activities. In order to gain an understanding of the relationship between social media and coping mechanisms, there will be a variety of data collected such as self-reported surveys that includes time tracking resources, and analyzes social media users utilizing alternative coping methods such as mindfulness and exercise. One objective is to determine whether social media is an effective tool for emotional well-being or a counterproductive habit that disrupts focus, well-being, and self-regulation.

Celeste Servin, Anna Gasiorek

Dr. Matthew Domico

60C A Multi-Data Analysis on H1-B Visa Selection Process

Graduate Student Project in Engineering, Computer Science, and Mathematics

The H-1B visa program provides skilled international professionals with a vital opportunity to gain employment in the United States. However, due to the overwhelming number of applicants exceeding the annual visa cap, the selection process relies on a randomized selection system. While this system is intended to be fair, questions persist regarding whether certain applicant or employer characteristics influence selection outcomes. This research analyzes publicly available H-1B visa selection data from 2021 to 2024 to identify potential patterns and disparities in the selection process. We employ data analysis and machine learning techniques to examine factors such as employer size, industry type, job location, wage levels, and applicant demographics to determine whether these characteristics correlate with higher selection probabilities. Preliminary findings indicate that while the selection system is designed to be random, some variables may be associated with higher selection rates, suggesting possible structural biases. These insights could have significant implications for policymakers, employers, and international job seekers, contributing to discussions on employment-based immigration policies and visa allocation fairness. By shedding light on these trends, this study aims to enhance transparency in the H-1B selection process and helps in ensuring equitable access for all applicants.

Sai Sree, Koneru Omer, Berk Gorgun, Anabel Aguilar Ramirez, Srinu Pamuluri

Dr. Mahmood Alkhasweh

63C A Multivariate Approach for d-Band, Band Gap and O2p Band Center Prediction

Graduate Student Project in Engineering, Computer Science, and Mathematics

This project aims at developing and applying several machine learning and data-driven techniques for electrocatalytic carbon dioxide (CO2) reduction catalysts discovery. Every solid has its own characteristic energy-band structure. The variation in the band structure is responsible for the wide range of physicochemical characteristics observed in various materials. In this project, we focused on using Machine Learning for predicting the d-band and O2p band of ordered perovskite materials. Exploratory data analysis, factor analysis, was used to select features that would provide the best prediction results. We also suggested a list of possible compositions to be synthesized in the lab.

Srivani Madhav

Dr. Mahmoud Alkhasawneh, Dr. Ward Logan, Dr. Ahmed Farghaly

66C Cryptography GUI Tool: A Secure Encryption and Decryption Solution

Graduate Student Project in Engineering, Computer Science, and Mathematics

Cryptography is a critical aspect of data security and privacy, providing the means to protect sensitive information from unauthorized access. Whether it's encrypting personal data or securing communication channels, cryptographic algorithms play a key role in safeguarding our digital world. This project aims to develop a versatile cryptographic tool with a graphical user interface (GUI), enabling users to encrypt and decrypt both strings and files using a range of cryptographic algorithms. The tool will support classical ciphers, stream ciphers, block ciphers, public key ciphers, and hashing algorithms, offering a broad spectrum of encryption options. The proposed Cryptography GUI Tool will cater to both beginners and advanced users by providing an intuitive and user-friendly interface built with PyQt5. This tool will serve as an educational resource for individuals learning about cryptography and a practical utility for professionals needing to secure data and communications.

Philemon Pottolla

Dr. Rami Khasawneh

69C Cybersecurity Knowledge Application

Graduate Student Project in Engineering, Computer Science, and Mathematics

Cybersecurity has become an important topic within the past few years. Having those who will participate in the up and coming workforce know what proper cybersecurity habits to practice will greatly benefit not only the organizations they work for but also themselves. This project will utilize a survey that will be distributed to members of the Lewis University community to see what their base knowledge is. The result of this would be to create a tailored application that can supplement the knowledge about the cybersecurity topics that were asked about in the survey. It will contain information about the topics on the survey, as well as the most popular topics that were suggested by those taking the survey. The importance of having this information readily available to the users would mean that they would be able to protect themselves against potential cyber attacks.

Katherine Groppe, Marcos Garcia

Dr. Rami Khasawneh

72C Dynamic All-Electric Vehicle with Intelligent Devices (D.A.V.I.D)

Graduate Student Project in Engineering, Computer Science, and Mathematics

This presentation outlines the objectives, approach, and conclusions of the Dynamic All-Electric Vehicle with Intelligent Devices (D.A.V.I.D.) project, which advances the development of a safe, reliable, and fully electric go-kart-style vehicle equipped with AI-driven computer vision for intelligent obstacle tracking, throttle control, and automatic regenerative and frictional breaking. The project expands upon the original D.A.V.I.D. prototype by integrating AI algorithms, real-time object tracking, and improved braking and throttle control. The vehicle now features an upgraded depth camera system with real-time AI-based obstacle detection, recognition, prediction, and dynamic speed adaptation. The D.A.V.I.D. project seeks to merge the appeal of recreational electric vehicles with advanced autonomous technology, setting a new standard for safety and performance. By enhancing its AI-driven perception, decision-making, and vehicle control systems, this project delivers an electric kart that ensures a more efficient, interactive, and secure driving experience.

Austin Schaibley, Eric Ortiz

Contributors: Brindyn Schultz, Alec Hoster, Aaron Skonieczny

Dr. Yazan Alsmadi

75C Utilizing Mn-oxidizing *Pseudomonas Putida* MnB1 to Explore Water Electrocatalysis via Intercalation of Various Metals

Undergraduate Student Project in Natural Sciences

Summer Undergraduate Research Experience (SURE)

Mn-oxidizing microorganisms oxidize environmental Mn(II) producing Mn(IV)-oxides. *Pseudomonas putida* MnB1 is a widely studied organism for oxidizing manganese (II) to manganese (IV) by a multicopper oxidase. The biogenic manganese oxides (BMOs) produced by MnB1 and similar organisms have unique properties compared to non-biological manganese oxides. Previous studies have indicated that BMOs have high surface areas and high reactivities along with an amorphous, poorly crystalline structure. It is also known that abiotic Mn-oxides promote oxidation of organics and have been studied for their water oxidation catalytic function. MnB1 is grown and maintained and subsequently transferred to culturing media containing manganese (II) salts to observe the oxidation of manganese (II) to manganese (IV). Various transition and rare earth metals have been incorporated into the BMOs, and their structures have been characterized by scanning electron microscopy, energy dispersive X-ray spectroscopy, and water electrocatalysis has been assessed. The results of this study will be presented.

Elisa Morales

Contributors: Cole Johnson, Anthony Baudino

Dr. Kari Stone

78C Clinimetric Properties and Patient Group Validity of The Chicago-Quick Hand Function Test

Graduate Student Project in Nursing & Health Professions

Doherty Center for Aviation and Health Research

This proposal aims to explore the clinimetric properties of the newly developed Chicago-Quick Hand Function Test (C-QHFT), a performance-based outcome measure (PBOM) designed to comprehensively assess hand function. Despite the availability of several PBOMs, current tests often fail to include key components such as in-hand manipulation (IHM) and psychomotor skills, limiting their effectiveness in evaluating hand function comprehensively. The C-QHFT incorporates various hand function components, including grasp, four IHM components, fine motor coordination (FMC), dexterity, release, and psychomotor skills, and has demonstrated strong psychometric properties in healthy adults. However, it has not yet been validated in a patient population. The study will employ a quasi-experimental quantitative design to assess the known group validity of the C-QHFT in adult patients with hand impairments. It will also determine the minimal clinically important difference (MCID), minimal detectable change (MDC), and the floor and ceiling effects. Participants will include adults receiving outpatient hand therapy. The study aims to compare C-QHFT scores between healthy adults and patients with hand impairments, establish an impairment scale, and further validate the tool's clinical utility. The findings will contribute to the refinement of hand function assessments in clinical settings.

Marina Morcos, Justin Arevalo, Adam Valera, Baltazarc del Rosari, Isabella Prado, Rose M. Scaliatine

Dr. Kumar Amrendra

81C Enhancing Clinical Competence: Tutoring Senior Nursing Students in a Critical Care Course

Graduate Student Project in Nursing & Health Professions

This educational project aims to enhance clinical competence among senior Bachelor of Science in Nursing (BSN) students during their critical care rotation. Guided by the Constructivist Learning Theory, the project focuses on strengthening students' knowledge, critical thinking, and clinical judgment by implementing structured peer tutoring sessions. Key objectives include improving students' understanding of intensive care unit (ICU)-specific conditions, fostering familiarity with Next Generation NCLEX (NGN) content, and evaluating the impact of active learning strategies both virtual and in person. The methodology involves a multi-faceted approach, including case studies, game-based learning, and NGN-style questions grounded in the National Clinical Judgment Measurement Model and Constructivist Learning Theory. Tutoring sessions, delivered both virtually and in-person, will incorporate active learning techniques to engage students and reinforce theoretical knowledge. Pre- and post-program surveys will measure changes in students' confidence, knowledge, and preparedness for ICU settings. Attendance and format preferences will also be analyzed to determine optimal engagement strategies. Preliminary results from the literature indicate that active learning techniques, such as case studies and game-based learning, significantly improve students' retention of critical care concepts and boost academic performance. Peer tutoring has been shown to enhance confidence and understanding, while NGN-style questions improve clinical judgment.

Amy Shulfer, Kara Clarkin, Amanda Gorsuch, Christie Berndt, Stephanie Sicinski

Dr. Donna Martin, Dr. Renea McKneown

84C Enhancing Safe Sleep Practices Through Integrated Media Approaches

Graduate Student Project in Nursing & Health Professions

Sudden Infant Death Syndrome (SIDS) is the primary leader of infant mortality, and caregiver compliance to safe sleep guidelines is critical for prevention. While traditional educational methods are widely used, digital media platforms offer innovative opportunities to enhance caregiver knowledge and practice. This study evaluates the effectiveness of a multi-media approach—comprising educational videos, Facebook groups, simulation trainings, and personalizing health messages—compared to standard educational materials in improving caregivers' knowledge and application of safe sleep practices during hospital stays and up to three months postpartum. A quasi-experimental design was employed with two groups: one receiving standard educational materials and the other exposed to multi-media tools. Caregiver knowledge will be assessed at baseline, hospital discharge, and three months postpartum using validated surveys. Safe sleep practice implementation will be evaluated through caregiver self-reports and observational audits at three months. The digital and interactive tools are expected to encourage active engagement and provide accessible, consistent education that positively influence caregiver behavior. The multi-media approach will significantly improve the caregivers' understanding and application of SIDS prevention guidelines.

Henrietta McDonald

Dr. Kimberly Scheffel

87C Escape Room: An interactive Way to Teach Hypertension to Nurse Practitioner Students

Graduate Student Project in Nursing & Health Professions

Hypertension is a significant comorbidity in the United States. Nurse Practitioners (NP) should be familiar with the diagnosis and treatment of hypertension to prevent complications for their patients. An escape room provides a fun and interactive way for NP students to learn and build skills. Escape rooms promote engagement, teamwork, and communication, and allow nurses to make mistakes in a safe environment while also building on their leadership skills. The purpose of this activity was to increase NP students' knowledge of treating patients with hypertension in the ambulatory setting in a fun and engaging way. Four unfolding case scenarios were presented in an escape room format that covered four types of hypertension: essential hypertension, secondary hypertension, "white coat" hypertension, and malignant hypertension. Puzzles requiring critical thinking and clinical reasoning skills were developed and participants were timed throughout their completion and eventual "escape." Surveys measuring students' perception of their hypertension knowledge were offered during a pre-brief and debrief, and another survey was conducted to measure students' satisfaction with the escape room activity. Students reported increased knowledge of how to treat a patient with hypertension after completing the escape room. Most of the students rated their satisfaction high for this interactive type of education. The escape room was a fun and engaging way to enhance NP students' knowledge of hypertension. Further, the NP students were satisfied with this learning experience.

Christine Jewell, Marsha Wellehan, Patricia Balogh, Nyssa Amato

Dr. Tricia Littig, Dr. Donna Martin

90C Evaluating Potential Target for Metallo-beta-lactamases Antibiotics Using Substitution Mutations

Undergraduate Student Project in Nursing & Health Professions

Beta-lactamases are enzymes critical for bacterial defense against antibiotics, where they hydrolyze the beta-lactam ring prevalent in all prominent antibiotics, disrupting cell wall synthesis. The most common inhibitor, clavulanic acid for beta-lactamases, does not bind to metallo-beta-lactamases that rely on zinc ions to hydrolyze beta-lactam rings. One common type of metallo-beta-lactamases with antibiotic resistance is New Delhi metallo-beta-lactamases (NDM). Antibiotic resistance due to beta-lactamases is becoming more prevalent. Since the genes are found on mobile genetic elements and often carry other resistance factors, it has become increasingly more difficult to treat infections caused by beta-lactamases. Due to horizontal transfer, metallo-beta-lactamases are becoming increasingly more common. There are no inhibitors that can target all metallo-beta-lactamases because each has slightly different amino acids in and around the active site. Many mutations are currently being explored to find antibiotics for metallo-beta-lactamases, specifically the G222D and M154L mutations in the NDM variant in this presentation.

Fatima Sohail Warraich

Dr. Kari Stone

93C Exploring the Impact of Pelvic Floor Health on Quality of Life in Women One to Ten Years Postpartum

Graduate Student Project in Nursing & Health Professions

Pelvic floor disorders are common among women, and it is projected that the number of American women with at least one pelvic floor disorder will be 43.8 million by 2050 (Weimer et al., 2024). Pelvic floor dysfunction impacts women beginning in early adulthood, and more women are impacted as age increases, with up to 50% of women over the age of 80 affected with pelvic floor dysfunction (Weimer, 2024). While all individuals are at risk of pelvic floor dysfunction, pregnant women are at a higher risk (Romeikiene & Daiva Bartkeviciene, 2021). The pelvic floor is a unique body system within females. This system controls bladder and bowel control, plays a role in postpartum recovery, and deals with urinary incontinence. When this system is damaged, it can create issues with physical activity, social participation, and engagement in sexual activity. For women in general, over time, this system can become weakened from childbirth, obesity, and constipation issues. Female pelvic floor dysfunction is treated by occupational therapists, physical therapists, medical doctors, or specialists such as urologists. Communication between healthcare providers and patients with pelvic floor dysfunction is a crucial aspect of client-centered care. Patients may not discuss symptoms or seek treatment with a care provider because they may not be knowledgeable about pelvic floor dysfunction and treatment or because they might wait to seek treatment until symptoms become severe (Burkhart, 2020). Patients are often hesitant to talk with care providers about the side effects of pelvic floor dysfunctions out of embarrassment (Grimes, 2023).

Jessica Kowalczyk, Sylvia Kobylak, Lynn Arcuri, Maddy Wade, Melissa Ramirez, Sydney Fedderly

Dr. Amrendra Kumar

96C Home Exercise Program Adherence Post-Stroke

Graduate Student Project in Nursing & Health Professions

Stroke (CVA) rehabilitation focuses on helping clients improve their daily occupational performance. Facilitating changes in occupational performance is challenging because therapy may be limited due to external factors. Therefore, activities outside of the clinic strive to enhance occupational performance through various techniques. One method to overcome potential therapy session limitations are home exercise programs (HEPs). Home exercise programs have shown to be effective in motor recovery and improved occupational performance. However, there are many barriers to adherence to HEPs for clients that have experienced a stroke (Scorrano et al., 2018, Simpson et al., 2013). To promote adherence and positive outcomes, occupational therapists should understand the client's barriers and enablers before implementing HEPs. Adherence to HEPs during therapy and after discharge is imperative for consistent progress throughout a client's recovery. A literature review was conducted to critically appraise the topic. The results of the literature review support the positive effects of adhering to HEPs. Through this research, adherence to HEPs has been shown to promote overall well-being and improve quality of life. Given the limited research on this topic, further investigation is needed to assess the effectiveness of adhering to HEPs.

Courtney Germany, Stephanie Ellinghaus, Lauren O'Gorman, Isabelle Oboza, Neena Cornelious, Suleima Rubio

Dr. Eron Bozec

99C Impact of Dietitian Consultation on Adherence to Heart-healthy Diets in Cardiac Rehabilitation Patients

Alumnus Project in Nursing & Health Professions

Cardiovascular disease (CVDs) is one of the leading causes of morbidity and mortality worldwide, emphasizing the need for effective strategies to manage risk factors (World Health Organization, 2023). Nutrition is one of the most powerful and effective options. This Critically Appraised Topic (CAT) addresses the PICO question: In patients participating in cardiac rehabilitation, does dietitian consultation, compared to standard care without dietitian involvement, improve adherence to a heart-healthy diet? PubMed was used to identify five relevant articles. These studies were appraised using the Critical Appraisal Skills Programme (CASP) tools to assess quality and relevance. Four articles provided Level 2 evidence, while one was Level 3. The review focused on the role of dietitian-led interventions in CR programs.

Results: Findings indicate with the leading of dietitians, individualized approaches, such as promoting adherence to Mediterranean and heart-healthy diets, significantly improve patients' dietary adherence and reduce risk factors like high cholesterol, blood pressure, and recurrent cardiac events. Evidence also highlights the value of practical dietary supports, such as personalized guidance and follow-up sessions. However, barriers like time constraints, cost, and cultural dietary preferences can limit adherence, underscoring the need for telehealth services and culturally sensitive counseling to bridge these gaps. The recommendation is assigned a grade B using the Strength of Recommendation Taxonomy (SORT), supporting dietitian consultations in CR programs. Dietitian support improves dietary adherence and outcomes in CR patients. Future research should assess cost-effectiveness, optimal consultation timing, and accessibility strategies.

Nguyen Guyen

Dr. Cathy Bohlin

102C Markers of the Mind: A Scoping Review of Biomarkers for Cognitive Tracking in TBI

Graduate Student Project in Nursing & Health Professions

It is known that traumatic brain injury (TBI) can result in various types of impairments, one of those potentially being in cognition. Traditional means of assessing TBIs of all severities rely on clinician-administered assessments such as the Montreal Cognitive Assessment (MoCA), Cognitive Linguistic Quick Test (CLQT), or the Mini-Mental State Examination (MMSE), which, although reliable objective means of measurement, still have their limitations. New methods of assessing cognition objectively are being researched, such as utilizing biomarkers to detect cognitive impairment in TBI patients. Objective: This scoping review aims to synthesize the literature on biomarkers as a means to track cognitive changes in TBI patients. It also examines the types of biomarkers researched for this purpose and collection methods. Following the Arksey & O'Malley framework, the databases PubMed, ASHAWire, and EBSCOHost were searched using designated search strings and exclusion/inclusion criteria. Once the literature was identified, the data was extracted and put into a table for synthesis. Results: The literature supported the association between GFPA, Nf-L, tau proteins, UCH-L1, BDNF, NDE, neuroimaging, SNTF, S100B proteins, NSE/sNCAM, and various cognitive functions. BDNF levels in acute serum were highly associated with TBI patients' memory impairment. Tau proteins were positively correlated with cognitive function and demonstrated changes in protein levels across 6 months. For clinical application, BDNF appears to be the most promising. Although further research is still needed, using biomarkers to assess and track cognition in a clinical setting is promising. Various biomarkers have been found to predict long-term cognitive impairment.

Isidro Galvez

Dr. Ann Guernon

105C Menstrual Hygiene Management for Students with Intellectual Disabilities

Graduate Student Project in Nursing & Health Professions

Menstrual health management skills are important for participation in meaningful occupations, particularly for students with intellectual disabilities (ID). In Occupational Therapy, menstrual health management is an activity of daily living under the category of toilet and toilet hygiene. Occupational therapy can educate on these skills and can adapt to students' understanding to promote the generalization of skills to manage their menstrual health. The aim of this research is to understand if adapted menstrual hygiene management intervention for students with ID will promote the acquisition of skills needed to manage menses. The investigators conducted a systematic review on this critically appraised topic through specific search terms and engines following inclusion criteria, such as an age range of 10-21, ID, and menstrual health management as a keyword. Four peer-reviewed journal articles within the last six years were selected after six were reviewed. Moderate quality evidence supports individualized and group menstrual hygiene management interventions such as demonstrating pad placement on dolls, peer training, social stories, and video modeling. More high-quality research on practical follow-ups of adapted interventions with this population is needed to determine the generalizability and application of menstrual health management skills long-term. Future research should be conducted to determine the benefits of occupational therapy's role in increasing independence in menstrual health management for students with ID.

Lillian Gaskin, Hailey Godbout, Ashley Murphy, Shannon Neumann, Kayla Alvarez, Laura Murguia, Isabel Guillen

Dr. Audre Chaput

108C Perceptions of Parenting After Stroke

Graduate Student Project in Nursing & Health Professions

Stroke (CVA) is experienced by 12.2 million people worldwide every year, and this can result in drastic role changes in a person's life. Decreased mobility, movement, cognition, visual and perceptual skills, communication, and emotional dysregulation can severely alter relationships with family and friends. In addition to improving daily living skills, Occupational Therapists (OTs) can reduce the impact that CVA has on close relationships. While research is abundant regarding CVA's impact on motor, communication, and cognitive abilities, very few explore how CVA affects roles, such as parenting. A literature search of multiple electronic databases was conducted to assess the impact of CVA on parenting roles. After narrowing search terms and a thorough abstract review, four qualitative studies were included. Literature results described the relational, physical, and emotional impacts of CVA. There is a marked lack of research on how CVA deficits change parenting capabilities and roles. Also, further research is needed to outline OT interventions that can effectively address these deficits. Due to the small sample size, generalizable conclusions and recommendations for the entire population were unable to be determined. OTs should explore role modifications with clients who have suffered a CVA to increase quality of life, relationships, and improve emotional well-being.

Casey Bruce, Madelynn Cosgrove, Jessica Escobedo, Peyton Miller, Kristen Rousonelos, Derek Stuart, Elizabeth White

Dr. Eron Bozec

111C Tackling Deficits with Strengths: Differential Treatment of Nonfluent Primary Progressive Aphasia and Primary Progressive Apraxia of Speech (nfvPPA/PPAOS)

Graduate Student Project in Nursing & Health Professions

Nonfluent primary progressive aphasia and primary progressive apraxia of speech (nfvPPA/PPAOS) are forms of frontotemporal dementia (FTD) that impair expressive language via breakdown of language and speech motor mechanisms respectively. To survey intervention studies targeting expressive language deficits in adults with nfvPPA/PPAOS and ascertain any trending differences between treatment approaches for nfvPPA and PPAOS. Three databases were searched using keywords: nonfluent primary progressive aphasia, primary progressive apraxia of speech, frontotemporal dementia, expressive language, and speech therapy. Searches returned 125 records, with nine articles remaining after applying exclusionary criteria. Data from articles were extracted on study design parameters, participant characteristics, and treatment outcomes. Studies were categorized into four groups: AAC (n=1), grammar-based (n=2), rhythmical entrainment (n=1), and script training (n=4), including group (e.g., double-blinded RCT), single-subject, longitudinal, and qualitative studies. Participants were with

aphasic/apraxic severities from mild to severe and greater than 1-year post-diagnosis. Sessions ranged from 30-60 minutes, once to twice per week, for 12-48 sessions over 4-24 weeks. Impairment-based outcome measures were frequently used, albeit often intervention-dependent, with generalization reported for four studies. Four treatment categories for nfvPPA/PPAOS were identified with reported improvements and identified treatment recommendations, including dosage and intervention suitability based on impairment severity. No studies directly compared intervention outcomes across the nfvPPA/PPAOS spectrum, precluding conclusive generalizations about appropriateness of surveyed interventions for one population over the other; however, potential combinations of intervention approaches emerged from data, highlighting the need for further research in developing them.

Zachary Oesterreicher

Dr. Ann Guernon, Dr. Karen Czarnik

114C Understanding Postoperative Feeding Difficulties in Children with Cleft Lip and Palate: Insights from a Scoping Review

Graduate Student Project in Nursing & Health Professions

Children with cleft lip and/or palate (CLP) undergo initial repair surgery to address feeding, breathing, and speech development concerns. Despite this primary intervention, multiple subsequent operations are often necessary to resolve aesthetic and functional issues. Although the initial surgery addresses immediate challenges, many children continue to face postoperative feeding and swallowing difficulties. These persistent complications remain understudied, indicating a significant gap in research on CLP management and long-term outcomes.

Laura Rios, Mari Ilano

Dr. Czarnik

117C First Responders and Firearm Safety: Shaping Effective Education Strategies for Safe Storage

Undergraduate Student Project in Education & Social Sciences

In 2020, firearms became the number one cause of death for children ages 1-18 in Illinois and across the United States. These deaths are not just from an uprise in firearm violence and homicide, but can also be attributed to suicide, unintentional, and accidental deaths. Many of these deaths could be prevented if firearms were properly stored and kept away from children. Currently, there are no requirements mandating safe storage education, though Illinois has started implementing safe storage laws. Moreover, there has been little research done on the most effective and best ways to educate individuals on safe storage. Our research gets the point of view from first responders in Chicagoland to hear about their preferences for safe storage education across multiple settings, including healthcare, educational, employee, religious, and community-based outreach. First responders as a potential outlet for receiving education was also one of our primary focuses. Findings suggest the medium in which this education. Being provided is of utmost importance when informing their children about firearm safety. Additionally, community engagement through various events or within schools would be an effective route. These findings can help shape safe storage education programming moving forward with support from those who are highlighted as key educators for safe storage in the community.

Jenna Hall, Byron Kelly

Dr. Hannah Klein

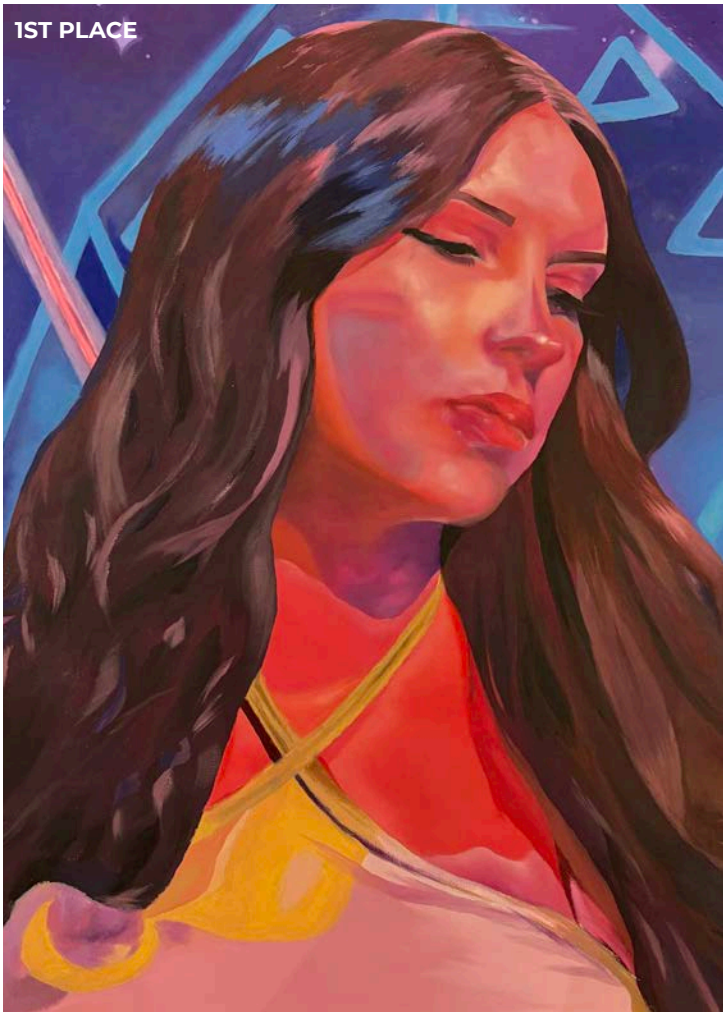
PRESIDENT'S 17TH ANNUAL ART EXHIBITION

APRIL 24
ART GALLERY

2–3PM

GALLERY TALK

Winners from the President's Art Exhibition, will discuss their works.



Art exhibits will be displayed throughout the day in the Art Gallery.

1ST PLACE

Annabelle Makselan
"Electric Madonna,"
Oil on Canvas

2ND PLACE

Franchesca Ornelas
"Dissonance,"
Acrylic Paint and Colored Pencil

3RD PLACE

Katie Melzer
"Bear Hug,"
Oil on Canvas

HONORABLE MENTIONS

Bowie Dauner
"When It's Good, It's Really Good," Acrylic and Oil on Canvas

Carissa Hoover
"Obi," Clay

Long Nguyen
"I'm Moggin' It,"
Oil on Canvas

Erika Ornelas
"Victim of Limerence,"
Charcoal on Paper

Jasmine Pryor
"Down to Mars Girls,"
Acrylic on Canvas

Jen Purdy
"Groovy," Charcoal on Paper

Madison Sea-Macak
"Polaroid Pets,"
Charcoal on Paper

Victoria Walus
"The Same But Different,"
Charcoal on Paper

Prize money donated by Dr. David J. Livingston, Lewis University President

ALUMNI AWARD

Prize donated by the Wadsworth Family Gallery

Barbara Eberhard '74
"A Blur," Mixed Media

CREATIVE WORKS

APRIL 24
KEITH WHITE THEATRE
3:10–4:30PM

154 The Toll it Takes and Excerpt from "Advocate"

Undergraduate Student
Project in Performing Arts

This emotionally charged scene from the larger play Advocate explores the strain infertility places on a marriage. Through intimate dialogue and raw vulnerability, Rebecca and James confront the weight of financial hardship, unfulfilled dreams, and the fear of losing each other. Inspired by personal and collective experiences, this work challenges societal expectations of family and resilience. The result is a poignant glimpse into love tested by struggle, offering a deeply human reflection on hope and identity.

Director's Note: The Toll It Takes is deeply personal to me. As someone who has faced the emotional, physical, and financial struggles of infertility, I wanted to create a piece that captures the raw reality of what so many couples endure in silence. This scene is not just about loss—it's about love, resilience, and the difficult choices that redefine a relationship. Through Rebecca and James, I hope to give voice to those who feel unseen in their pain, and to spark conversations about the unspoken toll infertility takes on individuals and families.

Sara "Sei" Barbour

Dr. Kevin Trudeau

27 Godspell 2012 Lighting Design

Undergraduate Student
Project in Visual Arts

This project was developed as a part of the Phillip Lynch Theatre's production of Godspell 2012. The lighting is designed to complement the chosen setting of Joshua Tree National Park, highlighting its vast different qualities of skylight and landscapes, bringing to life the magnificent purples and oranges of its sunsets and rises, its beautiful starry night sky, and demonstrating how light reflects and glows against its rocky mountains.

Gabe Seemann

Andrew Nelsen

128 Lifecycle

Undergraduate Student
Project in Visual Arts

I plan to create a projected installation utilizing projection mapping to create a visual experience projected in the core of a rebuilt fallen tree exploring themes of humanity, morality, and connection with nature. The tree was found in the woods behind the De La Salle Building. This installation will be exhibited in the Phillip Lynch Theatre building. This projection will be a cumulative representation of both my fine art studies and my graphic design studies as a Lewis University student.

Morgan Vergo

Kristin Callahan

136 Moses Fleetwood Walker

Undergraduate Student
Project in Visual Arts

This film explores the life of the first African-American baseball player, Moses Fleetwood Walker, his criminal trial, and his subsequent political career. His work is based upon David Zane's "Fleet Walker's Divided Heart", Oberlin College Library, and the national baseball hall of fame. Moses Fleetwood Walker challenged racial barriers in sports and American society. *https://drive.google.com/*file/d/1CQ_pD39fyquWe9WJEm0iNDYP2QDJ1yyG/view?usp=drive_web

Alberto Vazquez

Contributors: Jaden Elmore

Dr. Zia Huma, Dr. Jenkins Morris

151 Music Driven Motion (2D)

Undergraduate Student
Project in Visual Arts

This series of 2D animations responds to student-composed music, translating sound into motion to enhance its expressive impact. Using deep listening and iterative experimentation, artists interpreted rhythm, tone, and texture through abstract animation techniques. The project revealed how animation extends music's sensory experience, creating a dynamic fusion of sight and sound.

Amanda Dewey

Contributors: Katherine Morrow, Long Nguyen, Franchesca Ornelas, Jannah Salameh

Kristin Callahan

150 Music Driven Motion Design (3d)

Undergraduate Student
Project in Visual Arts

This series of 3D animations responds to student-composed music, translating sound into motion to enhance its expressive impact. Using deep listening and iterative experimentation, artists interpreted rhythm, tone, and texture through abstract animation techniques. The project revealed how animation extends music's sensory experience, creating a dynamic fusion of sight and sound.

Matthew Bilinski

Contributors: Emilia Connell, Erika Ornelas, Alexis Pragides

Kristin Callahan

63 The Beauty of Abstraction

Undergraduate Student
Project in Visual Arts

This project explores the fluidity of lines, a theme I explore within my paintings, and will experiment with this through animation. This animation will consist of painting with oil and acrylic on glass with the addition of music. I will use digital technology to create a stop motion animation. From the results of this project, I hope to understand the principles of animation better and the different ways I can adapt that to my artwork.

Jasmine Pryor

Kristin Callahan

165 The Same But Different

Undergraduate Student
Project in Visual Arts

"The Same But Different" was created to portray the evolution of self, emphasizing the stark differences throughout life, all while confronting the inevitable sense of continuity. Additionally, maturation is unyielding as it is unidirectional and inevitable. A human goes on to live "many lives," figuratively speaking, and regardless of all this change, they are biologically the same as the day they were born. I hoped to display this harsh, raw, yet, beautiful reality into something tangible.

Victoria Walus

Leslie Colonna

CREATIVE WORKS

KEITH WHITE THEATRE

3:10–4:30PM

82 The Simplification of Everything

Undergraduate Student Project in Visual Arts

An artistic study on the future of art reflecting the effects of widespread media consumption. This artwork will represent the schizophrenic-inducing algorithms of social media, and how overconsumption leaves no energy for individual creative exploration. Creativity thrives on sincerity and uniqueness, but it struggles to survive in a world dominated by digital noise. The power of art is shown through its expression of simple authenticity in a world dominated by the internet.

Paintings: *https://drive.google.com*/drive/folders/1-1YbLaE0jlQ6psh0RFXgQsLAWE-WVrkn?usp=drive_link

Katie Melzer

Leslie Colonna

152 Satellite Student Art Exhibition at Krema Coffee House, Lockport

Undergraduate Student Project in Visual Arts

This exhibition showcases original student artwork in a community setting, offering emerging artists a platform beyond the academic environment. Featuring a diverse range of media and styles, the work reflects individual exploration and creative growth. Through curation and presentation, students engage with professional exhibition practices while connecting with a broader audience. Ultimately, the show fosters artistic confidence, community engagement, and a dialogue between student artists and the public in an accessible, welcoming space.

Franchesca Ornelas

Contributors: Long Nguyen, Alexis Pragides, Erika Ornelas, Kate Melzer, Jenna Purdy

Kristin Callahan, Joseph LoPresti

OTHER EVENTS

Lewis University & Krema Coffee Roasters
presents:

SATELLITE EXHIBITON

April 8th - May 5th, 2025
917 S State St Lockport, IL

Come to Satellite, a special exhibition featuring artwork by Lewis Art and Design students to bring more creativity into everyday spaces.

Each piece on display reflects the curiosity, skill, and personal vision students develop through hands-on studio courses and close mentorship from faculty.

Featured Artists:
- *Katie Melzer*
- *Long Nguyen*
- *Franchesca Ornelas*
- *Alexis Pragides*
- *Jen Purdy*

Artist reception on April 23rd
12pm-2pm

PHILIP LYNCH THEATRE PRODUCTION OF

"Ride the Cyclone"

Directed by Kevin Trudeau

April 25-27 & May 1-4, 7 PM

Part comedy, part tragedy—and wholly unexpected—in this hilarious, outlandish, and wildly imaginative story, it delivers surprises at every turn.

The lives of six teenagers from a Canadian chamber choir are cut short in a freak accident aboard a roller coaster. When they awake in limbo, a mechanical fortune teller invites each to tell their story of a life interrupted—offering a prize like no other — the chance to come to terms with their fates & possibly the chance to return to life. At once quirky and smart, edgy and beautiful, Ride the Cyclone ultimately reveals the resilience of the human spirit in spite of senseless tragedy. This popular musical is a funny, moving look at what makes a life well-lived!

CELEBRATION OF SCHOLARSHIP

CO-CHAIRS

Dr. Matthew Domico

Dr. Marie Meyer

COORDINATING COMMITTEE

Dr. Kari Stone
Chair, Abstracts and 3-minute Competitions

Dr. Brittany Stephenson
Chair, Poster Sessions and Judging

Dr. Jason Perry
Co-Chair, Concurrent Sessions

Dr. Ana Roncero-Bellido
Co-Chair, Concurrent Sessions

Kristin Callahan
Chair, Creative Works and HASS Slam

Natalie Swain
Member, Creative Works

John Wightkin
Business Pitch Competition

Jenn Murdaugh
Chair, Marketing and Communications

Dr. Erik Baker
Co-Chair, Schlachter Award

Dr. Philip Blankenship
Co-Chair, Schlachter Award

Mardy Philippian
Member, Roundtable Sessions

Kelley Plass
Library Services

Elizabeth Atmore
Meetings, Events, and Conferences

Denise Salvino
Meetings, Events, and Conferences

Jim Cowan
Program Development

Deborah Vincent
Executive Assistant

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POSTER AND CONCURRENT JUDGES

Adam Schultze
Amanda Harsy
Ann Guernon
Anugna Gondi
Ayesha Fatima
Bushra Malik
Cara Sulyok
Chris Breier
Cindy Howard
E. Maria Wheeler
Eleftheria Karapas
Elizabeth Belgio
Elizabeth Sturm
Enrica Uhlen
Erin Zimmer
Eron Bozec
Fadi Wedyan
Hannah Klein
Indika Udagedara
Jeannine Haberman
Joe Kozminski
John Halloran
Kami Tsai
Kayla DeCant
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Mallory Havens
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Sam Ivetic
Sarah Drake Brown
Sarah Powers
Shanon Gillette
Sung Kim
Taeyong Kim
Yazan Alsmadi
Ziad Al-Sharif

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THIRTEENTH ANNUAL

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